

The London School of Economics and Political Science

**MAKING UP VALUE: TOWARDS AN
ETHNOGRAPHY OF THE NEW PRICE-SETTERS**

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A thesis submitted to the Department of Accounting
of the London School of Economics and Political Science
for the degree of Doctor of Philosophy

London, March 2018

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Abstract

This thesis aims to describe and analyse at once the sociotechnical logics that give essence to the mechanics of value-creation in a start-up in Paris's 'Silicon Sentier'. It is for this reason composed of two texts of deliberately disparate styles and statuses. The first essay pursues a threefold objective. The first is to provide detailed ethnographical data, produced by direct, participant observation, on a social world which is largely unknown, even more so as the received ideas which start-ups are subject to are widespread. On this basis, I then draw some of the governing principles of this entrepreneurial activity as it is carried out nowadays in the French start-up ecosystem, through this antagonistic relationship which links the start-up to the 'large firm'. Finally I sketch an analysis of value creation in which the organisation is at once the space, the instrument, and the target. The second essay revisits the 'performativity of economics' through the specific case of PriceMatch. I point out, firstly, how neoliberal policies of deregulation and the advent of information technology, made it possible the rise of an industry of revenue management technologies, of which PriceMatch is one of the most recent manifestations. Then, I indicate how the scientific literature on revenue management constitutes a reservoir of techniques and arguments in which the engineers of the start-up can draw on. Finally, I show how certain economic representations can emerge in a practical context, but how these can only be imposed through some ruses and artifices used by the start-up members.

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List of Abbreviations

ABLS	Automatic Booking Limit System
ACFAS	French and Canadian Association for the Advancement of Science [<i>Association canadienne-française pour l'avancement des sciences</i>]
AFS	Francophone Association for Knowledge [<i>Association francophone pour le savoir</i>]
ANT	Actor-Network Theory
ANVAR	French Innovation Agency [<i>Agence nationale de valorisation de recherche</i>]
AM	Account Management or Account Manager
API	Application Programming Interface
B2C	Business to Customer
BDPME	Bank for Small and Medium-Sized Enterprise Development [<i>Banque pour de développement de petites et moyennes entreprises</i>]
BU	Business Unit
CES	Consumer Electronics Show
CEPAME	California <i>Ecole Polytechnique</i> Alumni for the Master in Entrepreneurship
CDC	Deposits and Consignments Fund [<i>Caisse des dépôts et de consignations</i>]
CGE	Conference of <i>Grandes écoles</i>
CIR	Research tax credit [<i>Crédit d'impôt recherche</i>]
CNCE	National Contest of Business Creation [<i>Concours national de la création d'entreprise</i>]
CPGE	Preparation classes for entrance to <i>Grandes Ecoles</i> [<i>Classes préparatoires aux grandes écoles</i>]
CRM	Customer Relationship Management
EBS	European Business School of Paris
EMSR	Expected Marginal Seat Revenue
EMSU	Expected Marginal Seat Utility
ENA	National School of Administration [<i>Ecole nationale d'administration</i>]

ENSAE	National School of Statistics and Economic Administration [<i>Ecole nationale de la statistique et de l'administration économique</i>]
EM Lyon	Lyon Business School [<i>Ecole de management de Lyon</i>]
EPIC	State-controlled entity of an industrial or commercial nature [<i>Etablissement public à caractère industriel ou commercial en France</i>]
ESSEC	Higher School of Economic and Business Sciences [<i>Ecole supérieure des sciences économiques et commerciales</i>]
FNA	National Seed Fund [<i>Fonds national d'amorçage</i>]
FSI	Strategic Investment Fund [<i>Fonds stratégiques d'investissement</i>]
GDP	Gross Domestic Product
HEC	School of Higher Education in Business [<i>Ecole des hautes études commerciales</i>]
ICT	Information and Communications technology
IEP	Institute of Political Studies [<i>Institut d'études politiques</i>]
INSEAD	European Institute of Business Administration [<i>Institut européen d'administration des affaires</i>]
INSEE	National Institute for Statistics and Economic Studies [<i>Institut national de la statistique et des études économiques</i>]
IT	Information Technology
JCEF	Young French Economic Chamber [<i>Jeune chambre économique française</i>]
JEI	Young Innovative Enterprise [<i>Jeune entreprise innovative</i>]
KPI	Key Performance Indicator
IEP	Institute of Political Studies [<i>Institut d'études politiques</i>]
IMF	International Monetary Fund
ISF	Solidarity Tax on Wealth [<i>Impôt de solidarité sur la fortune</i>]
MCA	Multiple Correspondence Analysis
MIT	Massachusetts Institute of Technology
MVP	Minimum Viable Product

NES	New Economic Sociology
OECD	Organisation for Economic Co-operation and Development
OR	Occupancy Rate
PIA	Future Investment Program <i>[Programme d'investissements d'avenir]</i>
PMS	Property Management Software
PODS	Passenger Origin-Destination Simulator
PROS	Pricing and Revenue Optimization Solutions
R&D	Research and Development
RCS	Trade and Companies Register <i>[Registre du commerce et des sociétés]</i>
RFC	An exclusively indigenous term that refers to a low-tech, borderline-illegal technique used at PriceMatch if there is no API, in order to establish a working connection between customers' PMS and the start-up's servers to retrieve up-to-date booking data.
RM	Revenue Management
RMS	Revenue Management System
SAAS	Software as a Service
SAS	Simplified joint-stock company <i>[Société par actions simplifiées]</i>
SME	Small-Medium Enterprise
TEPA	Labour, Employment and Purchasing Power Law <i>[Loi en faveur du travail, de l'emploi, et du pouvoir d'achat]</i>
TGV	High-speed train <i>[Train à grande vitesse]</i>
UPMC	University Pierre and Marie Curie <i>[Université Pierre et Marie Curie]</i>
X	<i>Ecole Polytechnique</i>

Acknowledgements

Like a start-up, a doctoral thesis is the product of a long-term and collective endeavour, which requires not only boundless energy and unshakable perseverance but also concrete means of subsistence. In the present case, the material and financial support was essentially provided by the London School of Economics and Political Science (LSE) whose generosity I am happy to acknowledge here.

In particular, the Department of Accounting granted me a scholarship to come to The Big Smoke to allow me to dedicate myself to my persistent interests in sociology for four years; it took me to colloquia (Amsterdam, Stockholm); and it supplied me with a desk in a practical and convivial shared office, without which I could not have carried out the correspondence analysis presented in this thesis. My teachers there, especially Peter Miller, Martin Giraudeau, Andrea Mennicken, Michael Power, Martha Poon, and in neighbouring departments, Juan Pablo Pardo-Guerra (Sociology), Mary Morgan (Economic History), and David Graeber (Anthropology), challenged and stimulated me all through this research. I would like to thank Peter Miller and Andrea Mennicken for having supported me from the outset in an enterprise which, because it demands constant self-appraisal and sacrifice, could not have been brought to fruition without constant moral. Their encouragement, their advice, and their understanding when I felt the need to interrupt my studies helped me, in my moments of doubt (and depression), find the strength to persist in my investigations.

My gratitude also goes to all those, colleagues, relatives, and friends, too numerous to be named here, who assisted, stimulated, and comforted me during and after this research—they know who they are and what I owe them—, and to Bhakti Mills (and her cat), for the love and patience with which she escorted me all the way through these laborious years.

Finally, it goes without saying that this thesis would not exist without the generosity and trust of my colleagues from PriceMatch and of its cofounders

Baptiste, Adil, Julien, Léo, and Elias¹; I hope that they will see in this text the sign of my esteem and friendship, in spite of making them feel slightly caricatural at times by the inevitable reductionism of sociological critique. Likewise, I would have never set foot at PriceMatch without the mediation of my friend Matthieu Ségol, to whom I am deeply grateful for having put me through to Baptiste. I wish to extend my appreciation beyond PriceMatch to all the hotel managers and receptionists who welcomed me in their properties, and to the entrepreneurs, business angels, mentors, and investors in several cities who together taught me the subtleties of the hotel industry and so-called ‘new economy’ respectively. The names of a few individuals and locations as well as incidental details of events have been disguised when necessary to ensure confidentiality.

A brief note on translation is in order. Indeed, the materials collected in the course of investigation were originally, in their vast majority, in French. I was alerted early by the salience of language among the inhabitants of the new economy and so I sought to retain the linguistic specificities of the milieu studied. To better capture the idiom of the start-up, I asked help from native speakers to translate the utterances, conversations, and quotes contained in the thesis. I am especially thankful to Matthew Jones for his diligence and professionalism, even when things got pretty hectic in the final few weeks before submission. Again, the LSE Department of Accounting deserves high praise for covering the costs of transcription and translation of a number of excerpts from interviews.

¹ The names of all participants have been pseudonymised.

Letter to the Examiners

Dear Ebba Sjögren and Al Bhimani,

The text that I submit for your examination has been subjected to significant changes, which I propose to get back to, one-by-one, following the final report that has been conjointly drafted by you (dated 7 September 2017).

Concerning, first of all, form or organisation of the thesis: The introduction (Chapter 1 in the first version of the thesis) has been rewritten from scratch to indicate the hybrid nature of my object of study; Chapter 2, about the emergence of the techniques and the science of revenue management, has been revised and completed with the data of the inquiry conducted in the start-up to show how the logic of politics intervenes in the determination of prices in a practical case (this issue is the subject of Part 2 of this document); Chapter 3 and Chapter 4 has been edited and gathered together in Part 1 to try to shed light on the mechanics of value-creation that come into play in the start-up; Chapter 5 on pricing practices in a large hotel group has borne the cost of this reorganisation and has been removed, for the sake of consistency, to allow me to quasi-exclusively direct my attention to the case of the start-up; likewise the deletion of conclusive Chapter 6, which the main lessons can be found in the last section of Part 2. Next, the substance.

The aim of the study should be stated within the first five pages of the thesis.

The introduction of the thesis, as I said, has been started again to come to terms with your first comment. Contrary the previous version that presented the thesis in the light of the issue of price formation, I point out the substantive duality of my research, by retracing the staggered and wavering thought process that led me to make the start-up as an object of study in its own right, rather than only as a context in which certain pricing talks and practices take place. To know more about my objectives, I invite the reader to refer in particular to the first paragraphs in pages 20 and 25 (respectively p. 1 and p. 5 of the introduction), in which I come back to the fundamentals of the sociological project, as defined by Max Weber.

Include in the opening chapter a short review of the accounting/economics literature on pricing to make clear the void this study seek to address.

In chapter 1, clarify which specific questions within the sociology of prices literature this study addresses.

The issue of price formation is addressed in Part 2 of the thesis, which seeks to contribute, through the case of revenue management, to the long debate about ‘embeddedness’ initiated by Karl Polanyi. It is for this reason focused on the issue of economic representations, and in particular on what American anthropologist David Graeber has called the ‘paradox of performativity.’² However, this is at the expense of the process and variables involved in price formation, of which I will only provide here limited information. Finally, please note that a literature review of sociology of prices is available at the end of the first section of Part 2.

Identify in chapter 1 or 3 the methodology adopted, why an ‘eclectic’ approach is appropriate, what is at stake ontologically and epistemologically in coupling positivistic and constructivist research paradigms. Is there an element of ‘action research’ or is part of the investigation pure ethnography? Also explain the rationale for considering two cases.

The methodological approach I have adopted in this thesis is resolutely ‘qualitative’. In this regard, it is noteworthy that the regression model on price determinants, presented in Chapter 5 of the previous version, had no interest other than its illustrative value. It raised a problem (that in the case of revenue management it is not so much regularities in prices but irregularities that matter) and paved the way to the study of *pricing*, instead of that of *prices*, which, at least to my mind, would be best addressed through the ethnography of price-setting practices. If it is true that observing and participating are never neutral acts, the materials thus collected are not the product of a deliberate action to transform the

² David Graeber, ‘The Sword, the Sponge, and the Paradox of Performativity: Some Observations on Fate, Luck, Financial Chicanery, and the Limits of Human Knowledge,’ *Social Analysis*, 56 (1), 2012, p. 25-42.

knowledge and practices of the members in the organisation studied, as in traditional action research.³ Thus, my intention was not to make a claim about ‘reality’, nor to argue in favour or against a particular approach. (I am myself sympathetic with a critical realist approach, such as developed by Andrew Collier, where value does exist in nature and would exist even in the absence of humans, but, like freedom, exists in higher degrees in each emergent level of reality⁴).

Chapter 3 contents should be linked more directly to the research question and conclusion/findings. There is room possibly for shortening this section of the thesis.

Chapter 4 arguments and findings and their links to performativity issues need to be clarified. Provide a more developed discussion of where ideas are enacted, or not—and how ideas are mediate. Consider the more in-depth use of a select number of analytical concepts to distinguish between different versions of price and discuss their interrelationship.

Chapter 3 and Chapter 4 have been brought together to form Part I. Part I is an ethnographic study of a French start-up specialising in hotel revenue and pricing management, and traced the company’s trajectory from inception to exit to elucidate how value is being negotiated and constituted politically and materially in the present digital moment. The new version of this text retains its deliberately descriptive style, while trying to link it with theoretical work in the anthropology of value, to restore to the heart of my study the mechanics of value-creation that characterise the start-up as such, that is, as an instrument of creativity and innovation as well as a commodity liable to financial valuation. A discussion of the

³ This is of course rather simplifying. The boundary between research action and ethnography is much more porous than usually perceived, as attested by William Foote Whyte’s *Street Corner Society* (subtitled *The Social Structure of an Italian Slum*, Chicago, IL: Chicago University Press, 1943) that is considered as a reference work for both ethnographers and action researchers.

⁴ Andrew Collier, *Being and Worth*, New York, NY and London: Routledge, 1999.

findings can be found at end of section 2 (p. 87 onwards) and section 4 (p. 144 onwards) of this essay.

Some other minor amendments have been made to the text within the part, to add some more details and to ensure consistency: The start-up is not simply the space of intense work but also the support of a form of ‘sociability’ (see p. 56-7); most start-up members are men and the management is fundamentally a masculine space (see p. 81-2); the typical day of the skilled workers of the so-called ‘new economy’ (p. 96 onwards); finally, a few boxes have been dragged and dropped from one section to another, as it is the case of ‘The Promises of the New economy’ (p. 88 onwards), the portraits of Baptiste and Léo, two of the cofounders (p. 89 onwards), as well as that of one of their clients (p. 108 onwards), and the account of one of the ‘Monday meetings’ (p. 103 onwards).

Chapter 5 presents part of pre-doctoral research data. Explain why this data is seen to have direct links to the doctoral thesis’ aims and broad concerns particularly in relation to the performativity arguments advanced in the conclusion.

Chapter 5 has been removed from the thesis.⁵ The reader may wish to refer to Part II to know my views on the debate of the ‘performativity of economics’.

Chapter 6 needs developing and more ample delineation and argumentation of the thesis findings. The chapter should address the more general claims which the study makes about the characteristics of the “price factory”, where it is located and how it operates, so that such a calculable space might be identified and understood in other settings. There is room for more lucidly identifying the conceptual advances the thesis makes, and how the

⁵ The text has been divided in two papers that are available online, see Vassily Pigounidès, ‘Note on the Determinants of Prices,’ working paper, 2017 [online]. <https://drive.google.com/file/d/1qGRxdrvEhC9UJOLvgRxHxLHCBHz4qv-P/view> [Accessed: 30 March 2018]; Vassily Pigounidès, ‘The Work of Setting Prices in a Large Hotel Resort,’ working paper, 2017 [online]. https://drive.google.com/file/d/1gMyVsk2hmdyoizUmVj6o1RVuvLg62s_r/view [Accessed: 30 March 2018].

conclusions further the prior literature (as outlined in a revised version of chapter 1, see above).

My doctoral research has allowed me—in my eyes at least, but the readers can judge for themselves—to know more about what a start-up is in general, and about the structure and functioning of a start-up in the internet economy in France at the end of the 2010s in particular, as well as to better appreciate what distinguishes this start-up from the large firm. I recused the wrong idea, deeply entrenched in popular consciousness, that the new economy is a ‘nihilistic’ world, characterised by greed, money, and success. The start-up enabled me to connect theoretical analysis with empirical description and thus to challenge the ‘moralising’ vision the new economy and its participants, and to put back centre stage the value-creation mechanisms that defines the start-up as it is, that is, as the space and the tool of the creative and innovative work of its occupants and the target of investors and other business angels.

Finally, I would like to conclude by thanking you for the open, precise, in-depth discussion, as tense (at least from my point of view) as useful and constructive, that we had at the viva, and for the comments and the suggestions that you have forwarded to me, which have served as a starting point for my revisions—it is not everyday that one is given the chance to discuss his research work with attentive and informed readers, and I certainly appreciate this opportunity.

London, March 2018

Introduction

A Hybrid Object

This thesis is both a kind of ethnographic *description* recounting my personal experience in an innovative company in a neighbourhood in the 2nd arrondissement of Paris, otherwise known as ‘Silicon Sentier’ for its role as a hothouse of internet start-up entrepreneurship, and a sociological *analysis* of price formation. It aims to suggest the fruitfulness of an approach that looks at ‘value’, as David Graeber contends, as ‘a way people’s own actions become meaningful to them, how they take on importance by becoming incorporated into some larger system of meaning’.⁶ Sociology must seek to grasp and contain this essential dimension of existence—which is particularly notable in the case of the start-up that is at once the subject and the object of valuation processes, as a space for creativity and innovation for its members and a commodity for investors—through in-depth investigation, in the field, to try to understand and explain ‘what is important, meaningful, desirable or worthwhile’ in people’s world.⁷

I landed in PriceMatch by default and by accident. At the time, I was seeking an observation point from which to scrutinise the actors, tools, and know-how involved in revenue and pricing management practices, which I had undertook to study during my master studies in France.⁸ From the outset it seemed to me meaningless, both for epistemological reasons and by personal taste, to write about price formation without getting first-hand experience in the workplace, considering

⁶ David Graeber, ‘Value: Anthropological Theories of Value,’ in James Carrier (ed.), *A Handbook of Economic Anthropology*, Aldershot, UK: Edward Elgar, 2005, p. 439-54, p. 453 (quote).

⁷ David Graeber, ‘Value’, *ibid.*, p. 439.

⁸ Philippe Steiner and Pierre-Paul Zalió gave both the initial impetus for looking into the issue of price formation, while I attended as part of my master degree a research seminar they held on the ‘economic sociology of prices,’ and their supervision and guidance for my master’s thesis on *The Work of Pricing in a Large Hotel Resort* (Master Thesis, Paris: Paris-Sorbonne University and Cachan: Ecole normale supérieure of Cachan, 2011).

the many and various market forms as well as processes and variables that come into play in price-setting practices (a plurality, incidentally, that a four-month internship carried out in the summer 2011 in a large hotel group had offered me a glimpse of, and that I decided to place centre stage in the study I conducted at the time, as part of my master thesis, which aimed at identifying and defining distinct logics of valuation that existed simultaneously within the same organisation). And because the normal economics of the mechanisms of price formation seemed to me riddled with mathematical models that oversimplify the reality of the economy by projecting onto it the abstract and normative construct of the perfect market, beginning with the tale of ‘supply and demand,’ an alleged law of markets that conveniently allows scholars to dismiss the concrete procedures whereby prices are actually calculated by focusing attention on the search for equilibria, partial or general, and the admitted ‘imperfections’ of the markets.⁹

After months spent in a vain quest for a placement where I could insert myself to observe the work of revenue managers or yield managers¹⁰, a friend who

⁹ Bernard Guerrien and Emmanuelle Bénicourt, *La Théorie économique néoclassique. Microéconomie, macroéconomie et théorie des jeux*, Paris: La Découverte, Collection « Grands repères Manuels », 2008.

¹⁰ Finding a sympathetic manager proved extremely difficult. I approached airlines (American Airlines, Delta Air Lines, British Airways, EasyJet, Air France-KLM), railways (SNCF, Thalys, Eurostar, East Coast, Amtrak, Via Rail) hotel chains (Accor Hotels, Marriott International), and even tried my luck with manufacturers like Coca-Cola that had experimented with revenue management techniques for its orange juice operations (see Duane Stanford, ‘Coke Engineers Its Orange Juice—With an Algorithm,’ *Bloomberg*, 1 February 2013 [online]. <https://www.bloomberg.com/news/articles/2013-01-31/coke-engineers-its-orange-juice-with-an-algorithm> [Last consulted on 3 March 2018]), all to no effect. Part of the reason for these setbacks was the often politically sensitive nature of revenue management. Revenue management is irritating for the general public as for example the success of this petition that reached 100,000 signatures, that is, the threshold for being considered for a parliamentary debate, urging British Members of Parliament to ‘stop holiday companies charging extra in school holidays’ indicates (see <https://petition.parliament.uk/archived/petitions/46455> [Last consulted on 3 March 2018]) – I have elaborated on this example elsewhere, Vassily Pigounidès, ‘The UK’s Holiday

studied economics put me in touch with Baptiste, a former classmate from Sciences Po and one of the cofounders of a French start-up, specialising in hotel revenue management. I contacted him immediately, out of curiosity, and because I found myself pressed for time, with then only two years left until the submission date. And right after my first visit I started an ethnographic journal. Here is the first entry:

5 June 2014. I contacted Baptiste, he quickly replied, and we agreed to meet in his office in Paris. I visited them at the beginning of June 2014, on a hot spring afternoon. Baptiste was around my age, perhaps a little younger, unshaved and tousled, wearing a dark, corporate branded tee-shirt, which made him very likeable to me from the outset. He offered me a coffee and led me to the meeting room, which appeared to serve as his own private office. He presented me PriceMatch, without a break in his clear-toned and confident voice, exactly as if I was one of his potential clients—in business jargon, he pitched to me. First he briefly introduced himself and his partners, emphasising the prestigious institutions they went to; then, he gave me a demonstration of the platform and its main features; he concluded with the price—on average, their clients would be charged 200 euros per month, but it depended on the number of rooms in the property. But I was not a hotelier, and when I kept going on about the algorithms behind the platform (I believe he got tired of answering my questions), he got Charlie and Maxime, two developers who were in charge of these issues at PriceMatch, in order to satisfy my curiosity and give himself a break. We talked for some time. Although they were not exactly chatterboxes, I remember being quite amazed by how indiscreet they were about what they considered to be shortcomings of the algorithm—manifestly, they had received no orders from their boss to keep quiet. Such an openness stood out nicely from my previous experiences with the profession and gave me courage to tell Baptiste about my intention of doing a participant observation at PriceMatch. ‘You can start whenever you want,’ he said. (Field notes, 5 June 2014)

Prices,’ *Risk&Regulation*, spring 2014, p. 14-5. Another reason is the fact that pricing has traditionally been seen as a trade secret in these industries, which is reflected, among other things, in the lengthy legal battle, starting in the early 1990s, between American Airlines and their competitor Northwest Airlines and its European partner KLM Royal Dutch Airlines, the former accusing the latter for allegedly stealing proprietary information and trade secrets related to American’s revenue management capacities.

For once I had entered the start-up, I found myself confronted with a thorny problem, that of my original project: Should I confine myself to consider the start-up as a *context* in which to set prices? My long immersion in the start-up and my direct participation to the activities it hosts have encouraged me—rather in spite of myself—to temporarily look away, to deepen my understanding of what a start-up is in general, and my analysis of the structure and functioning of a Parisian start-up in the so-called ‘new economy’ in France at the end of the 2010s in particular, as well as to better appreciate what distinguishes this ‘innovative entrepreneurship’¹¹ from the rest of the corporate world.

For four months, I worked alongside the members of PriceMatch, at the frantic rate of twelve hours a day, applying myself to the conditions of an effervescent, highly flexible working environment. Following in their wake, I performed various and many tasks, from cold calling prospective clients to responding to calls to tender, or even contributed to overhauling their accounting information system. The friendship and trust accorded to me by the members of the PriceMatch team were such that I was able not only to blend in among them in the start-up but also to accompany them in their everyday peregrinations outside of it, in their meetings with hoteliers, hunting for clients and partners at commercial events and cocktail receptions, on the rooftop of the Hotel Raphael for a glass of champagne, in search for sponsors at the tourism office of the City of Paris, as well as at the Quai d’Orsay to meet with the principal private Secretary of the Minister of Tourism. My start-up colleagues allowed me to share in their joys—when a juicy contract was signed with a hotel chain—and sorrows—when a member of the team was laid off—, their after-work drinks, pinball and table football games, and house parties. I saw no less than seventeen people coming and nine people going during the summer of 2014 and I witnessed, at their side, the closing of the start-up, bought by Booking.com in May 2015 and a month later the departure for Amsterdam of the bulk of the team.

¹¹ Philippe Mustar, ‘Innovative Entrepreneurship in France,’ in OECD Reviews of Innovation Policy: France 2014, Paris: Editions OCDE, 2014, p. 225-63.

From August 2014, and taking advantage of the relative lull in activities, I started conducted a series of over thirty in-depth interviews¹² with members then active in the start-up to know more about their motivations to join the company and their expectations as well as their actual work—be they engineers, account managers, salespeople, or IT technicians. Together with the notes, observations and recordings made day-to-day in and around the start-up, these interviews provide the materials for the essays that follow.¹³

From the beginning it was clear that, to avoid common sense preconceptions (as Emile Durkheim would say), a sociology of start-ups has to resist the sensationalist discourse quickly adopted by the media in their characterisation of the so-called ‘new economy’ as a whole—the resounding exits, by acquisitions or IPOs¹⁴, the heroism of the social ascent of the outcasts (‘Facebook's Mark Zuckerberg: from Harvard hijinks to hoodie billionaire,’ eloquently claim a reporter of *The Guardian*¹⁵), the exceptional lives and careers of the ‘self-made’ entrepreneurs. It must instead apprehend the start-up through its less well-known and least dramatic side: the drab and dreary routine of the office, of the long hours

¹² See Appendix A for more details.

¹³ These ethnographic observations were complemented and triangulated with the results of a questionnaire survey (nearly seventy people of PriceMatch replied to the online form, that is, a participation of 75 per cent; see Appendix B), and at the end of the research journey by a number of interviews with hoteliers who used as well as with one of their business angels (the second investor of PriceMatch not having wished to answer to my questions) and by the dissection of the native literature (specialised magazines and brochures, technical publications) and its scholarly derivatives (legal and managerial writings). After the acquisition of PriceMatch, I also collaborated with another hotel revenue management start-up, which I visited on several occasions at the company’s head office in New York City and in the technical team’s premises in Sunnyvale in California.

¹⁴ Initial Public Offerings.

¹⁵ Josh Halliday, ‘Facebook's Mark Zuckerberg: from Harvard hijinks to hoodie billionaire,’ *The Guardian*, 18 May 2012 [online]. <https://www.theguardian.com/technology/2012/may/18/mark-zuckerberg-facebook> [Last consulted 3 March 2018]

of intense work, inherently scientific and business-oriented, which precludes the all-too-brief appearances at some prize-giving ceremonies; the daily and seemingly trivial rituals of the start-up life, which produce and reproduce the belief nourishing this very peculiar technological and moral economy that the digital world is. In short, to avoid the sweeping judgements that the mention of wildly overvalued firms never fails to conjure, one must temporarily look away from the entrepreneurial ‘success stories,’ that conceal the sweat and toil of the many, and get lumbered with the thankless jobs alongside anonymous workers of the new economy in their ordinary setting of the start-up.

The other edge of an approach based on participant observation in an average start-up is that the materials thus collected is not affected by the ‘fallacy of the single cause’ of which suffer most available studies and accounts on the new economy. Thus all the statements reported here, as well as the behaviours described of the start-up members, were systematically collated and triangulated to enhance validity, and to make it possible to render more precise and complete depictions of life inside the start-up, as well as more nuanced analyses.

This thesis seeks to suggest how the start-up actually makes sense as soon as one immerses oneself in its members’ everyday work and engages with them on their own terms. It is with this aim in mind composed of two texts of deliberately disparate styles and statuses, which place next to each other ethnographic description and sociological analysis, in order to express simultaneously some kind of symbolic system that define the start-up world in terms of what is important and meaningful, and pricing practices. In short, the thesis aims to describe and analyse at the same time the technical and political logic that gives essence to the mechanics of value-creation—including the creation of human beings—in an organisation of the French ‘start-up ecosystem’.

The first essay contributes to an understanding of the complex relations that link the ‘large firm’ to the start-up, and examines the activity within the start-up as a work of technical, economic, social, and moral valorisation, performed in a pragmatic and rhetorical mode, on the basis of a hybrid and mutable organisation,

that, progressively, brings this digital universe into being.¹⁶ It was in writing this text that I understood to what extent the start-up constitutes a research project in itself and decided to make the work in the start-up a second object of study, parallel to my investigations of price formation. This essay pursues a threefold objective. The first is to provide detailed ethnographical data, produced by direct, participant observation, on a social world which is largely unknown, even more so as the received ideas which start-ups are subject to are widespread. On this basis, I then draw some of the governing principles of this entrepreneurial activity as it is carried out nowadays in the French start-up ecosystem, through this antagonistic relationship which links the start-up to the large firm. Finally I sketch an analysis of value creation in which the organisation is at once the space, the instrument, and the target. This is to say that my intent is neither to denounce nor to defend this industry reputed as the most ‘cutting-edge’ of them all, so often praised and blamed, but rather to suggest what its specific mechanisms can teach us about the mechanisms of any value-creation.

The second essay, first drafted in 2013 and then revised and completed four years later with the material collected during my participant observation at PriceMatch, feeds into the long debate about ‘embeddedness’, which has gained renewed interest in recent years with the announcement by French sociologist Michel Callon that *economics performs the economy instead of simply describing it*.¹⁷ This essay revisits this effect through its relationship with a certain rhetorical and ‘political logic’, which acts on the determination of the prices suggested by the start-up. I point out, firstly, how neoliberal policies of open to competition, and especially the deregulation of the American sky that took place at the end of the 1970s, but also the advent of information and communications technology (ICT),

¹⁶ David Graeber, ‘It Is Value that Brings Universes into Being,’ *HAU: Journal of Ethnographic Theory*, 3 (2), 2013, p. 219-43.

¹⁷ A long debate initiated, as it is well known, by Karl Polanyi. See Karl Polanyi, *The Great Transformation: The Political and Economic Origins of Our Time*, Boston, MA: Beacon Press, 2001 [1944]; Michel Callon, ‘Introduction: The Embeddedness of Economic Markets in Economics,’ in Michel Callon (ed.), *The Laws of the Markets*, Oxford: Blackwell, 1998, p. 1-57.

made it possible the rise of an industry of revenue management technologies, of which PriceMatch is in fact only one of the most recent manifestations. Then, I indicate, resting on some published work in operational research on the issue of inventory management and pricing, how this literature will constitute a reservoir of both pragmatic techniques and rhetorical arguments in which the engineers of the start-up can draw on. Finally, I show how a model close to that formulated by neoclassical economists like Jules Dupuit can emerge in a practical context, but above all how these theoretical arguments can only be imposed through the ruses and the artifices which the start-up members use, even going so far as to incorporate these tricks into their algorithms.

To close this introduction, it is important to point out the main factors that made this research possible. The most decisive was no doubt the ‘opportunistic’ character of my insertion. Indeed, I did not enter the start-up with the express aim of analysing the new economy. My original intention was to use the organisation as a ‘case study’ onto the revenue management industry so as to observe the pricing strategies of a range of actors in the hotel industry—my initial object of study—and it was not until after four months of assiduous attendance, and after having looked at the material I had collected every which way, that I decided to make the work in the start-up an object of study in its own right. The hazards of economic life also determined that I would enrol in a ‘successful’ start-up, enjoying enviable growth since its inception in 2012 and acquired three years later by the travel website Booking.com for over twenty million euros, such that I was able to observe the milestones that have marked the short but turbulent history of the start-up.

The often politically sensitive nature of revenue management and the fact that pricing has traditionally been seen as a trade secret in business could have hindered my integration and thus diminished my capacity to grasp the social world of the start-up, if not the conjugated action of three compensating factors. First of all, the ethos of project management and network capitalism¹⁸ and pronounced anti-bureaucratic affect of start-up culture is such that everyone is accepted into it so

¹⁸ Luc Boltanski and Eve Chiapello, *The New Spirit of Capitalism*, Gregory Elliott (trans.), New York, NY and London: Verso, 2005 [1999].

long as she contributes to the achievement of the common objective—namely growth—, and is able to ‘make oneself useful’ for the company. Elias, cofounder and technical director at PriceMatch, explains:

Elias: Many people came at PriceMatch, and worked along us for most of them voluntarily or for some 436 euros as interns. ... And it is also in this context that you yourself are here, without being employed but bringing...

Vassily: I try to contribute as much as I can...

Elias: Let’s say you bring your added-value. But this is very much how we went about it. We didn’t say to ourselves: ‘Well, we’re going to take a PhD student and that’s going to be great because it will do this and that.’ It’s just opportunities that come. Like, someone says: ‘I’d like to come.’ ‘OK, come. Any ideas of what you want to do?’ ‘Yes, I want to do that.’ ‘Fine.’ And we gives him a project. Then, little by little, as he gets more familiar with the company, he has another idea and we have another idea. Anyway, that was just a little digression about our state of mind at PriceMatch, where we basically let people do their thing, come up with their own ideas, etc. And either it works for us and we keep going, or it doesn’t work and one way or another we bring it to a close (in general the person tells us: ‘Well, I’m not going to stay’). (Interview, 20 August 2014)

Next, my age, and also the fact that we attended the same places of study, contributed to my integration into the company, which was made all the more easier because its population forms a relatively homogeneous group from an educational and socioeconomic point of view. I benefited from the social homophily which prevails in the start-up (‘he was cut from the same cloth as us,’ explains Julien as he talks about Elias, the last member to join the founding team) and which is the support of the sociability relationships between its members. Finally, my total commitment to the requirements of the field, and in particular the fact that I accepted to do without reservations all the tasks—even the least rewarding—I was assigned to, earned me the confidence of my work colleagues, as attested by the job that Adil, cofounder and sales director of PriceMatch, offered to me—and, of course, that I had to decline—when I left the start-up for the first time at the end of the summer 2014.

Part I

1. The Start-Up and the 'Large Firm'

The universe of start-ups cannot be understood outside of the ecological context in which it exists and without considering the social possibilities this context has to offer. Indeed we will see that the start-up can be defined in terms of its opposition to what the indigenous perception calls the 'large firm.' To study the entrepreneurial activity demands an understanding of the structure of career opportunities offered to those who embark on business ventures, as well as their position in the social space—namely, the privileged situations of young graduates of the most prestigious French *grandes écoles*, fully integrated in the high-skilled labour market and in activities and networks related to a certain 'state nobility.'¹ Therefore it may be helpful, before stepping into the start-up, to provide the reader with a succinct portrayal of the so-called 'new economy' in France and its recent historical evolution. There is no comparison in terms of size and maturity between this 'start-up ecosystem' and what is going on in the United States, in particular in Silicon Valley where thousands of start-up companies are currently based. Nevertheless, it demonstrates a startling dynamism, at least compared to other industries of the French economy, following almost fifteen years of uninterrupted growth and increased public and private investments.

The Start-Up Ecosystem

In the aftermath of the dot-com collapse, the French new economy was a deserted and devastated battleground, bereft of funding sources, in which dozens of start-up companies had fallen.² The drop of the NASDAQ index on 13 March 2000 in New York, soon followed by that of the CAC 40 in September in Paris, triggered a cascading series of bankruptcies and forced mergers. Ten years later, the new economy had risen up from the ashes, establishing itself as one of the most dynamic sectors of the French economy. Between 2005 and 2011, start-up creation increased

¹ Pierre Bourdieu, *The State Nobility: Elite Schools in the Field of Power*, Lauretta C. Clough (trans.) Stanford, CA: Stanford University Press, 1996 [1989].

² Laure Belot, « Internet, pourquoi tant d'échecs », *Le Monde*, 15 January 2001.

by more than 500 annually, equating at the end of the period to about 10,000 technologically innovative enterprises,³ which employed 740,000 people and achieved revenue of approximately 200 billion euros.⁴ In 2010, amounts invested by French venture capital companies represented 0.042 percent of gross domestic product (GDP) in France whilst investments received by French enterprises was 0.038 percent—France being well above the European average, with 0.029 and 0.027 percent of GDP in Europe respectively. Also in 2010, total budgets raised by venture capital teams in France came to 916 million euros—31 percent of which, i.e. more than 284 million euros, coming from government agencies. In 2012, France Angels, the French association of business angel networks, had some 4,100 angels,⁵ spread throughout more than 80 association networks, which invested nearly 40 million in a little more than 350 companies (a third of this amount being used to refinance ventures that had already been financed), that is an average investment of 114,000 euros for each company financed.⁶ In an environment deeply

³ The French national statistics bureau (INSEE) does not provide any specific information on innovative companies with high growth potential. Furthermore, INSEE has a very restrictive definition of the digital economy as the group of producers of information and communication technologies. Therefore, it is necessary to look at ad hoc studies to gain a clearer idea of the number of start-ups created in France. The limitation of these studies, however, is that they do not allow for international comparability. In a note of the Organisation for Economic Co-operation and Development (OECD), Philippe Mustar proposes to integrate the findings of three of these studies and estimates at 225 to 700 the number of annual creations of technologically innovative companies in the period 1995-2011. ³ Philippe Mustar, 'Innovative Entrepreneurship in France,' in OECD Reviews of Innovation Policy: France 2014, Paris: Editions OCDE, 2014, p. 225-63.

⁴ OSEO, *PME 2012, Rapport sur l'évolution des PME*, Paris, La Documentation française, 2013, p. 198-204.

⁵ Business angels are affluent individuals who provide capital for a business start-up, and advise its creators, usually in exchange for convertible debt or ownership equity.

⁶ Information obtained from the French National Business Angels Federation, FranceAngels [online].

affected by a major economic crisis and relocations, drawing its inspiration from similar developments on the other side of the Atlantic and its European neighbours, the French government has taken numerous measures to ensure the emergence of an increasingly favourable climate for innovative entrepreneurship, enabling a resounding renewal of the new economy in France.

A brief overview of the many and various schemes set in place from the end of the 1990s give a measure of state voluntarism to renew the governance and ecosystem of start-ups in France.⁷ In 1999, imitating the American model of spin-offs from public research, the Innovation and Research Act was designed to foster links between public research and business. Between 1999 and 2008, the net balance was 2,060 companies created, over 950 of which stemmed from public research projects or researchers—i.e. a hundred companies per year. In 2008, the Finance Law radically reformed the research tax credit (CIR), making of this measure, which enables companies to deduct their expenditure on research and development (R&D) from their tax, the main instrument of public support for business R&D. Between 2007 and 2011, the cost of the CIR to the state rose from 1.7 billion euros to 5.1 billion euros. In 2011, Oséo agency, responsible for implementing policy on innovation and growth for small and medium-sized enterprises (SMEs), had financed, essentially through support schemes for investment, treasury and aid for creation, more than 68,000 companies, 51,000 of which being young and small innovative companies, for a volume of activity of 14 billion euros.⁸ Oséo was established in 2005 following the merger of the French Innovation Agency (ANVAR), the Bank for Small and Medium-Sized Enterprise Development (BDPME) and the Sofaris fund. In 2013, Bpifrance was created from the merger of Oséo, CDC Enterprises (a branch of the Deposits and Consignments

https://www.franceangels.org/images/stories/Newsletter/News_mars_13/Prsentation_chiffres_reseaux_de_BA_2012.pdf [Last consulted on 15 February 2017]

⁷ For a detailed account of the various schemes implemented in France to support innovative entrepreneurship and their assessment, see Philippe Mustar, 'Innovative Entrepreneurship', *art. cit.*

⁸ OSEO, *PME 2012*, *op. cit.*

Fund [CDC]) and the Strategic Investment Fund (FSI). With the creation of the FSI in 2008, endowed with 20 billion euros, this direct intervention in companies grew substantially. In 2004, the Young innovative enterprise (JEI) status offered exemptions from social security contributions for all employees engaged in research and from corporation tax for the first three years of operation, with a 50 percent reduction over the following two years (then, starting from 1st January 2012, a reduction of 100 percent in the first year and 50 percent in the second year) and an exemption from property taxes for eight years. Between 2004 and 2011, 5,200 companies benefitted from this scheme; 2,800 of these had this status in 2011. The 1999 Innovation Act, the focus of the CIR and Oséo aid on young technologically innovative companies and the creation of the JEI status, helped construct an innovation policy focusing on the creation and growth of young technology companies.

Like many French engineering or management colleges, which have devised since the 1990s training programmes which—more than in the past—include entrepreneurship and innovation in their curricula, the public authorities have also sought to diffuse in universities the ‘spirit of enterprise.’⁹ The establishment in 2001 of an Observatory of Teaching Practices in Entrepreneurship, the setting up by 2004 of *Maisons de l’Entrepreneuriat* (‘Entrepreneurship centres’) in several universities, and the launching in 2009 of a plan to develop entrepreneurship in higher education institutions are among the many awareness actions supported by the government.

As with other European metropolises, the City of Paris has, in recent years, launched a series of schemes in favour of innovative entrepreneurship. Between 2002 and 2012, the surface area of business incubators and business centres available for start-ups climbed from 5,000 to 78,000 square metres, and a further 25 000 square metres were being developed. Thus, 17 incubators were managed by *Paris Incubateurs* in 2012. This property policy, amplified by the contribution of large private corporations which financed it, has provided business creators with

⁹ Pascale Krémer, « Contre le chômage, l’université veut "diffuser l’esprit d’entreprendre" », *Le Monde*, 10 September 2014.

high-quality premises at competitive prices. As well as premises, start-up creators have been able to rely on logistical services, help with developing their market and fundraising, and contacts with the Parisian innovation ecosystem. Other schemes helped prolong the financial support policy of the government, via the creation, in partnership with Oséo, of the Paris Seed Innovation Fund in 2009, as well as enhance the visibility of Parisian start-ups: creation of the Innovation *Grands Prix* of the City of Paris, the launch of an Open Innovation Club by Paris Région Lab, and so on.

Most OECD countries have introduced policies to support the development of the venture capital industry. In France, since the end of the 1990s, the CDC and its subsidiary CDC Enterprises and then the FSI, both of which have now come under the umbrella of Bpifrance, have established various funds of funds in order to increase the availability of venture capital: Public Venture Capital Fund in 1998, Venture Capital Promotion Fund in 2000, Technology Fund of Funds in 2005, each with a budget of 150 million euros, *France Investissement* in 2006, with over 300 million euros per year (but a portion of this amount contributes to direct financing for innovative companies), and finally National Seed Fund (FNA), as part of the Future Investment Programme (PIA), endowed with 600 million euros.¹⁰ The various tax concessions granted to taxpayers subject to the wealth tax (ISF), under the 2007 Law in favour of Labour, Employment and Purchasing Power (TEPA), made it possible to raise over 1.2 billion euros in 2008. But the tax losses caused by these measures are significant—in the order of 500 million euros. This number demonstrates more than any the central position occupied by the new economy in French industrial and innovation policy.¹¹

¹⁰ For a recent assessment of public intervention in the risk-capital industry in France, see Marie Ekeland, Augustin Landier, and Jean Tirole, « Renforcer le capital-risque français », *Les notes du conseil d'analyse économique*, July 2016, n° 33.

¹¹ Inspection générale des finances, *Les Frais prélevés sur les produits financiers bénéficiant d'un avantage fiscal pour favoriser l'investissement dans les PME*, Paris, Inspection générale des finances, October 2009. On this matter, see also Cour des comptes,

Founded in April 2012, PriceMatch was a French start-up specialising in hotel revenue management. According to the Trade and Companies Register (RCS), PriceMatch was incorporated on 20 April 2012 at the *Tribunal de commerce* of Bobigny, in the form of a Simplified Joint-stock Company (SAS),¹² starting with a capital of 12,000 euros, financed equally by its four founders, Adil, Timothée, Baptiste and Léo. One year later, on 2nd April 2013, a change in share capital—increased to 84,000 euros—is recorded, as well as the arrivals of two new representatives, Julien and Elias, and the departure of Timothée—who eventually decided to leave the organisation to prepare the entrance examination for the National School of Administration (ENA), ceding part of his shares to his partners. The start-up was born into a historical context of support for innovative companies’ creation and development, which Baptiste, president and cofounder of PriceMatch, has paid tribute to, in a note published in the corporate blog: ‘Contrary to popular belief, the state supports innovative start-ups, and many ongoing projects give evidence of the progress being made in this respect over the past several years. As a young entrepreneur, I can only stress the key role played by public policies for innovation and business development. If perfectible, they have clearly helped us experience sustained growth. At a time when the public debate focuses on the obstacles to entrepreneurship in France and to the development of incubators in Europe, I wanted to stress that France supports innovative entrepreneurship in order for national champions to emerge.’ (Blog note, 2 June 2013).

Indeed, the start-up has benefited from numerous aids from public authorities in order to develop its activity. When created, it was accepted at the Science Po Incubator, where three of the founders were studying at the time; then, after a one-year rental in the Sentier area, it joined the Shaker from September 2014, a newly created incubator situated a stone’s throw away from the previous premises

Les dispositifs de soutien à la création d’entreprises, Paris, Cour des comptes, December 2012.

¹² A SAS (literally a ‘simplified joint-stock company’) is similar to a limited company in British law. This status is very much appreciated by start-up companies, as it permits a dissociation between power and capital: a partner can be granted prerogatives independent of his or her capital share, which is of particular interest when investors show up.

and established by Partech Venture, which took a stake in the capital of PriceMatch one year earlier. Under the PIA programme, financed by the City of Paris and Oséo, PriceMatch received a subsidy of 30,000 euros in 2012 and was granted, in January 2013, a loan on trust of 100,000 euros. In 2012, the start-up won the California Ecole Polytechnique Alumni for the Master in Entrepreneurship (CEPAME) grant of 20,000 dollars. This was financed by Ecole Polytechnique Alumni, of which one and then three cofounders—two of them joining the team from the summer of 2012—are graduates. In 2013, it won the Young French Economic Chamber's (JCEF) special prize at the Innovact Campus Award, as well as the first prize of the National Contest of Business Creation (CNCE). In 2012, the company obtained JEI status, enabling it to benefit from an exemption from social security contributions for the engineers employed by the enterprise and from property taxes (although it did not take advantage of the exemption from corporation tax provided for in this status as no net income was earned for the period). The start-up also received income tax reductions under the CIR on account of expenses incurred in R&D, and in 2013 received 90,000 euros from the French State in accordance with the CIR. In November of the same year, the company received 500,000 euros of financing from Partech Venture, through its seed fund, Partech Entrepreneur, which is at least partly financed by Bpifrance—the rest of the fund is financed by private corporations including BNP Paribas and Econocom. Another 500,000 euros from Hotelim, a business angel and hotel management and investment company whose properties subsequently paid for the revenue management services provided by PriceMatch, brought this fundraising to a total of one million euros.

Getting a 'Real' Job

In this economic and industrial context which 'gets better and better'¹³ according to Eric Carreel, president and cofounder of Withings, and where 'it is infinitely

¹³ Assemblée nationale, *Compte rendu n°79, Commission des affaires économiques*, Round table bringing together founders and/or CEOs of French companies of the digital economy, with Mr. Éric Carreel, cofounder and CEO of Withings, Mrs. Céline Lazorthes, founder and CEO of Leetchi, Mr. Frédéric Mazzella, founder and CEO of Blablacar, Mr. Ludovic

easier to be an entrepreneur today than twenty years ago,’ the start-up appears as a possible option compared to other more classic career patterns, of which salaried worker within a large firm constituted a sort of implicit counter-model for part of the French youth. ‘Administrative procedures are easier,’ Carreel continues, ‘and young engineers are happy to come and work in start-ups. Twenty years ago, they preferred to enter a big group.’ Thus, some young graduates of *grandes écoles* turn away from the conventional paths of success, as described by Pierre Bourdieu in the 1980s,¹⁴ in order to start their own business or to throw themselves into the start-up of another one, as illustrated in the columns of *Le Monde* by the case of one of them: ‘Gautier Dreyfus is a Polytechnique graduate. But the well-marked career path towards high-ranked public office is of little interest to him. ‘Repetitive positions, slow decisions,’ remarks decisively the young man, dressed like a student. He wanted to ‘continue to learn rather than work,’ so he created a start-up with a colleague: Forssea Robotics, which develops underwater robotics systems for industry. Over ten of his classmates have done the same thing, for the same reasons. Ten years ago making those choices would have been unthinkable.’¹⁵

Like this young entrepreneur, the founders of PriceMatch are graduates of the most prestigious French *grandes écoles*, namely Ecole Polytechnique and Paris Institute of Political Studies (Sciences Po). Like him, they cut their teeth, as interns, in the world of the large company, in French industrial groups or international financial institutions, and have a mixed memory to say the least, in fact a trauma for some, of these professional experiences.

Adil: I took a placement year. First, internship at Société Générale. Finance. I was bored to death. So after the third month I was just waiting for the end. Second I got a place at JP Morgan in New York. Then I had a chat with Baptiste. We spoke

Le Moan, founder and CEO of Sigfox, et Mr. Simon Baldeyrou, CEO of Deezer France, 30 September 2015.

¹⁴ Pierre Bourdieu, *The State Nobility*, *op. cit.*

¹⁵ Béatrice Madeline, « Loin des grands groupes, la nouvelle génération start-up voit le jour », *Le Monde économie*, 12 February 2017.

about the PriceMatch project, etc. and ended up saying ‘yeah, why not!’ (Interview, 22 September 2014)

Baptiste: I did three months at the IMF in Gabon. Then I came back and I started my internship at Goldman Sachs [in London] that was supposed to be a one-year placement. After seven months, I quit and I created PriceMatch. (Interview, 21 August 2014)

Léo: I did an internship at GDF Suez for a month, which was an internship in communication, where I didn’t learn much; then I did an internship at Orange for four months in Moscow, where what I really learnt was that... well, that you don’t learn much in large companies. At least as it happens I didn’t learn much. I didn’t really get along with my manager; I didn’t have the impression of making the contribution I could have, because the assignments I was given were really not interesting. It really confirmed my idea that I wanted to create my own company. (Interview, 24 September 2014)

In spite of their young age—between 21 and 23 at the time of the creation of the company—PriceMatch founders have had the experience of working within a large group, which appears to be the very reason that encouraged Baptiste to set up a business. In an interview conducted with him in August 2014 he noted: ‘The real trigger is that I was just having a bad time at Goldman Sachs [*j’ai badé*]; I told myself “I really need to find a way to get out of this!” Around that time I went to see Timothée in Dublin, who had just finished his internship at McKinsey. He said to me that he had a bad time too; he was at Google, he said to me “It’s not interesting at Google if you’re not a developer.” We told ourselves that the only thing that can really be interesting, in the spheres in which we find ourselves, is to try to start up our own business.’

The experience of a certain degree of frustration is indeed so commonplace that nearly all members of the start-up allude to it when questioned about their professional situation prior to PriceMatch. Many are familiar with the boredom of underemployment. Basile recalls his internship at the *Caisse des Dépôts*, within a public administration which, because of a change at the top of the hierarchy, suddenly went wrong, putting its employees into to a state of complete inactivity for months: ‘The first month went really well, I had a project, my [superior] was

very accessible, we talked a lot. After a month, with the political changes,¹⁶ there were also changes at the top of the *Caisse des Dépôts*. We were waiting for a new chief exec. The person that I was working with knew very well that he was going to be leaving, so for him there was no longer any point in working on strategy, thinking about the future. After that, when I sent emails, the wait for a response became longer and longer, or just never came. Basically, I actually worked for a month and a half, then just spent a month and a half of floating around. In the end I said to myself that I didn't want to spend the next three months doing nothing... so I started going to the incubator at Sciences Po to work on my own projects.' Many have shared this sense of a loss of meaning at work. Some of my colleagues at PriceMatch confided in me about their unease during previous professional experiences when performing certain types of tasks, or engaging in certain activities that they found morally questionable. 'I was in Paris at a firm called Solucom,' recalls Karim, 'that does consulting for the banking, insurance and energy industries, and advises on projects of digital development, technological change, etc. I was really uneasy about it... Spending your days doing Excel and PowerPoint files and performing analyses that are borderline scams... Because it's junior consulting, you're not an expert after the first four months. I was very much uneasy about it, it was deadly boring, and I didn't quite like the suit atmosphere as it was all about appearance, looks, etc. I asked to get fired.'¹⁷

In contrast to this boring and constraining environment, and despite the real difficulties that exist in the field of the new economy (long hours, low wages, and lack of job security), the start-up constitutes for its members a sort of refuge in the corporate world, where labour makes more (or less) sense again. The start-up seems to offer what the sociologist Alexandra Bidet has dubbed a 'real job' [*vrai boulot*],

¹⁶ The action in all likelihood took place in the spring of 2012 which saw, following the French presidential election, the Left coming back to power.

¹⁷ It is quite ironic to read on the company's website the following presentation: 'Founded in 1990, Solucom is an independent consulting firm, listed on Euronext Paris and certified Great Place to Work in 2015.'

in opposition to the ‘bullshit jobs’ of large groups¹⁸; a world in which each one is invested with increased professional responsibilities and where it is still possible to conduct a project from beginning to end and in all its aspects. This rejection of the large company, which can tend to the slightly cartoonish sometimes, is what makes possible the active commitment of the members of the start-up to their work, and goes a long way towards explaining its attraction. Carine is no more than an intern, yet she can confirm that she is considered a member of the group in her own right: ‘I have a huge amount of responsibility. As I told you, I’m completely autonomous, I know that they trust what I do two-hundred percent, I don’t have to report on what I’m doing to someone. Even though Ferial is my supervisor, she won’t go and look at my client platforms, she won’t check the emails that I send... That’s something that I probably wouldn’t have in a big company. Here I was straight away able to do things my way... The big advantage is the independence and the responsibility. I know that I’m seen as an employee, that I have the same opportunities, I’ve even got more clients than certain people in the team. Which is fantastic!’ Maxime, a developer who went from working on the ‘algorithm’ to ‘back-end’, explains the reasons why he decided to join the start-up: ‘After my internship, I started looking for a company. I didn’t seriously think about staying at Amadeus because I just don’t think it’s my cup of tea. It’s quite a big thing. It’s more for people who want to settle down once they’ve started a family and all that; they want something laid back. I preferred something more dynamic like here, like a start-up. That’s what I was looking for: a start-up or something smaller. I’ve experienced large companies. There was huge inertia, I couldn’t do much; you were trapped somehow, in the sense that you were going around in circles.’ ... ‘At Amadeus, there are either pure developers or guys who define the product, who write specs all day long; it’s like “Can I place a whitespace here or a capital letter there,” that kind of stuff. So it’s either you code and you do only that, you don’t think, you’re told to do this and that, and you write the lines; or you define the product and it comes down to writing docs and specs. It’s not really exciting. And I think it’s kind of the same everywhere.

¹⁸ Alexandra Bidet, *L’engagement dans le travail. Qu’est-ce que le vrai boulot ?*, Paris: Presses universitaires de France, collection « Le lien social », 2011. On bullshit jobs, see David Graeber, *Bullshit Jobs: A Theory*, London: Allen Lane, forthcoming.

The thing is that when you are in a big thing you're in a team that is extremely specialised; you're a tiny part of the company.¹⁹ What I like here is that you can do everything; you can get the big picture of the product, but also all the technical parts; you don't have to focus on something in particular.'

Indeed, it is common to define the start-up in relation to what would be its ideal-typical opposite, namely the large firm. Here are just a few examples from the interviews conducted at PriceMatch where the start-up would be characterised by: 'constantly changing tasks', rather than 'a cushy job where you're paid 1,000 euros more to doze with other people who are dozing' (Christine); 'a sense of mutual motivation' which is absent in large groups where 'the teams are very big, very slow' (Ilan); 'easier, more direct relationships' ... 'people are far more reactive in start-ups than in big companies' (Karen); or else would be perceived as 'a dynamic environment where everyone is a bit like you', unlike that of the 'big company where people have been in their job for ten years, don't ask questions, walk straight, as they've been told to' (Julien). Some employees claim that the start-up actually 'saved' them, as is the case with Philippe, who confesses that he would most likely have succumbed to a nervous breakdown at the time of his first job at the Paris City Hall if not for the opportunity to work at PriceMatch. And many French celebrity entrepreneurs, among them Frédéric Mazella, Jean-Baptiste Rudelle and particularly Ludovic Le Moan, do not hesitate to bring up their first-hand experiences in large structures, public or private, in order to highlight the supposedly innovative working methods implemented in their own companies. Presenting his project of a hacker house, Paul Poupet, cofounder of Seed-Up, marks out a vibrant indictment of the torment of the large firm during his September 2016 speech at the TEDx conference in Paris: 'I saw that before joining this company, you have to send fifty CVs, get through four interviews. Then I saw that once you've got through all that, they just want you to come and fill in Powerpoints, and that to do real projects you have to wait a few years. I also saw the internal

¹⁹ This echoes the sociological critical analysis of Georges Friedmann on assembly-line work, which smashes laborious activity to bits [*miettes*] and makes it an empty, meaningless shell. Georges Friedmann, *The Anatomy of Work: Labor, Leisure, and the Implications of Automation*, Wyatt Watson (trans.), Glencoe, IL: Free Press, 1961[1956].

organisation of these companies. I felt like I was in one of those history documentaries that they show you at school. You know, the stuff about taylorfordism, with the division of tasks and processes.’²⁰ Clara Deletraz, with Béatrice Moulin, turned these difficulties at work into a start-up project, Switch Collective, specialising in the ‘brown-out’ of executives and which aims at ‘helping employees find their own way in a world where there are no longer pre-marked paths laid out for them’. ‘I worked in big CAC40 companies’, she says, ‘but there was no meaning to what I was doing. So I reoriented myself towards the public sector with the idea of serving the general interest. But I couldn’t stand the inefficiency and bureaucracy.’²¹ Likewise, most young entrepreneurs interviewed by the reporters of *Le Monde*²² willingly emphasise the reality of the opposition between the start-up and the large company: ‘At 24 years old, Laura Beaulier has a CV that most parents could only dream of. Studied abroad, speaks four languages, sporty, prestigious internships, an MBA from HEC... Yet the young woman, doing an internship in marketing at Areva, feels “totally useless.” This is particularly worrying given that she has “always wanted to create something in her life,” she has done internships with social institutions and, above all, when she was little she read a story about a girl who took over a business.’ ... ‘It was all that was necessary to push Laura into starting out on her own after she finished her master’s at HEC, which had given her a taste for entrepreneurship’; ‘Graduates from ENSI in Caen, an engineering school specialising in electronic payment and data protection, Luc

²⁰ Paul Poupet, « Des hacker houses pour repenser l’innovation », TEDxParis, 13 September 2016 [online video]. <http://www.tedxparis.com/paul-poupet-des-hackers-house-pour-reorganiser-le-travail-a-lheure-du-numerique/> [Last consulted on 15 February 2017].

²¹ Sibylle Laurent, « Réunions à la chaîne, tâches absurdes et hiérarchie insatiable : le "brown-out", cette nouvelle souffrance au travail », LCI, 25 October 2016 [online]. <http://www.lci.fr/societe/reunions-a-la-chaine-taches-absurdes-et-hierarchie-insatiable-le-brown-out-cette-nouvelle-souffrance-au-travail-2009276.html> [Last consulted on 15 February 2017].

²² Béatrice Madeline, « Start-up : Pourquoi ils se sont lancés dans l’aventure », *Le Monde économique*, 13 February 2017.

Pallavidino et Antoine Louiset began their project as part of their degree. “We had neither the experience nor the money to train people,” notes Luc, who’s major difficulty was finding developers, much sought-after by start-ups. “In the beginning, we met a lot of students that wanted to work for major companies, but it’s a trend that seems to be reversing”; ‘Capucine Boulanger already has two employees on permanent contracts and two trainees. Currently in the process of recruiting a developer and a sales rep, she received around fifty applications for each post. “A lot of young people want to work in start-ups. They say that they want to do more varied work that advances quicker than in big businesses.” In interviews, the young woman “tells them what to expect”: lower wages at the beginning than in a big company, a lot of flexibility, less money spent on expenses... In return, candidates can have a serious hope of climbing the company ladder more quickly than in a traditional firm, and see their salary increase accordingly!’

Members of PriceMatch fully agree:

Cédric: Originally, I wasn’t at all thinking about doing this kind of thing [working in a start-up]. I mean, when I started my first year of *prépa*,²³ my dream was to be, like, a trader.

Vassily: Really?

Cédric: Well yeah, because I found having to go to work such a pain that I said to myself ‘If I have to work, I might as well be paid as much as possible’. When the crisis happened, I looked into what the banks and that do and it completely put me off! I dunno, I just found it disgusting. And so I stopped wanting to do that. In the end, I kind of found myself in the complete opposite, in a start-up.

Vassily: You don’t want to be a trader anymore?

Cédric: Back then, I thought that’s what I wanted to do. Then, when you work as an intern, you realise what it is to work. And you realise that being a trader, or whatever, working in mergers and acquisitions, that sort of thing, means working

²³ The *classes préparatoires aux grandes écoles* (CPGE), commonly called *classes prépas* or *prépas*, are part of the French post-secondary education system. They consist of two intensive years which act as a preparatory course with the main goal of training undergraduate students for enrolment in one of the *grandes écoles*.

9am to 10pm on a light day and 8am to 1am on a hard day, giving all your youth, from 24 to 32 years old... You can't keep up that pace for eight years! And you think 'Do I want to spend my youth at that pace? Do I really want to do that with my life? Do I really need that cash? Or aren't there jobs in which I can have a better balance between being in a cool place and making some good money because you're an engineer?' (Interview, 11 September 2014)

The opposition to the large firm represents one of the major virtues of the start-up for its members and orients the entire policy of its directors. It is expressed, among other things, by the total absence of any dress code in the organisation. 'The atmosphere is so different from a big company. You can dress how you want, listen to music.' Carine is quite fond of this custom. As she puts it, 'having a bit of liberty, not too many rules, it also makes you want to work'. This casualness is even present within the sales team, despite them being in direct contact with the hotel world where high importance is placed on these kinds of details: uniform is almost always imposed on the personnel by the rules and regulations of these companies. Nevertheless, this mind-set is not shared by everyone in the start-up. Thus, Samir, from all his seven years of experience in selling, considers the casualness as a generalised slackening that is likely to penalise the salespeople at PriceMatch in their relationships with hoteliers: 'They're clever but they're kids.' ... 'I find it incredible that they go to meetings looking so shabby! Alexandre at the beginning—I mean, now it's better, but at the start he would go to meetings in trainers with holes in them. Baptiste goes to meetings in an old polo that's falling apart.'

11 June 2014. I accompany Baptiste and Carine to Hôtel d'Orsay for my first client meeting. The property is situated on rue de Lille, in the 7th arrondissement, just up the road from the museum of the same name. It is a seventeenth-century, classical building with an ostentatious façade filled with arches and sculptures. A plaque indicates that the hotel has been granted four stars. Baptiste is waiting for us in the entrance hall, his motorcycle helmet in hand. He is chewing the fat with a hefty man in a three-piece suit. It strikes me that there is something not quite right about the situation when I see the two next to each other: Baptiste is true to form, unshaved and tousled, wearing an unironed shirt, bright trousers and worn-out trainers; then there is the hotel manager in his fifties and a very classical, plain, blue suit and tie. The other members of the team turn up in dregs and drabs: the

receptionist wearing the hotel livery (grey and purple), and two ladies with colourful skirt-suits and Hermes scarves. Carine and I look like a pair of overgrown adolescents: she has a black tee-shirt adorned with a big pink bow; my own get-up is no better. The contrast could not have been any more dramatic between the two groups, between the ageing hotel industry and the new economy, tradition and modernity.

‘Democratising Revenue Management’

Along with Duetto and some other smaller software publishers, Pricematch was one of a crop of recent entrants on a market of hotel revenue management systems (RMS) which has long been occupied by a handful of incumbent companies. These businesses, which include IDEaS and Easy RMS,²⁴ provided solutions reserved to large hotel groups and luxury hotels only, due mainly to high cost and complexity.²⁵ ‘A decade ago, RMS was exclusively the province of large hotels with high average daily rates,’ says a reporter of Tnooz, the main news website on innovation in the tourism and hospitality industries. ‘Industry pioneer IDEaS’s first client was a hotel so large it had four separate buildings. But RMS might go mass market as the cost

²⁴ Founded in 1989, IDEaS was acquired in 2008 by a larger software provider, SAS Institute; EasyRMS saw the light of day ten years later and was bought as well in 2012 by Infor (which is currently the third largest enterprise technology provider in the world).

²⁵ Several major hotel chains chose, from the end of the 1980s, to develop internally their own revenue management solutions, as was the case for example with Marriott International and Hilton Hotels. On the dissemination of revenue management in large hotel chains in the United States, see Robert G. Cross, Jon A. Higbie, and David Q. Cross, ‘Revenue management’s renaissance. A rebirth of the art and science of profitable revenue generation,’ *Cornell Hospitality Quarterly*, 50 (1), 2009, p. 56-81. In this article, the authors give an account of the transfer of revenue management techniques from the airline industry to hotels through a singular anecdote concerning the fortuitous meeting in the mid-1980s of J. W. ‘Bill’ Marriott, CEO of Marriott International, and Robert Crandall, CEO of American Airlines; the latter, they say, having confided to the former this ‘best-kept secret of the industry.’

for customers drops and as it becomes easier for customers to use.’²⁶ By adopting a type of Software as a Service (SaaS) model, these new companies have managed to offer revenue management services at affordable prices to a wider public, ranging from small independent hoteliers to large chains, and have accelerated the restructuration of this market. Indeed, an analysis of competition produced by PriceMatch reckons that the recurrent cost of the new entrants could be as much as twice as low as that of incumbent firms—the subscription amounts being between 250 and 400 euros on the one side and between 400 and 500 euros on the other, to which must be added a significant saving on installation and setting up costs estimated at 3,000 to 5,500 euros.

‘The ambition of PriceMatch is to industrialise and democratise revenue management for all hotels.’ [*Correspondence*, 28 April 2014] It is with these words that Baptiste presented, in the very first email I received from him, the aim of his company. It therefore defines itself in opposition to large groups—this time embodied by some large North American software publishers—and to the presumed clientele’s elitization of which these large groups are the vector. Its proclaimed goal is to lower revenue management tools’ prices to make them accessible to small independent hotels and to help them compete against large hotel groups, suggesting a sort of implicit alliance of the ‘smalls’ that the hotel industry and the new economy form against the major industrial power: ‘PriceMatch has given itself the objective of democratising yield management by making a web platform that is easy to use, well connected to existing tools (PMS and channel manager for hotels, ticketing software for event organisers, etc.) and automated for greater accuracy and rigour, at a price that is affordable for everyone’ (Blog note, 3 June 2013). Thus when salespeople of PriceMatch succeeded in landing their first contracts with large hotel chains, and in particular when its collaboration with

²⁶ Breanna Smith and Justin Kaminski, ‘An HVS Guide to Hotel Revenue Management,’ *HospitalityNet*, 22 July 2016 [online]. <http://www.hospitalitynet.org/news/4077285.html> [Last consulted on 15 February 2017]; Sean O'Neill, ‘Hotel revenue management software has its Pharrell Williams moment,’ *Tnooz*, 14 April 2015 [online]. <https://www.tnooz.com/article/hotel-revenue-management-software-industry-survey-2015/> [Last consulted on 15 February 2017]

Accor (now AccorHotel), the biggest hotel operator in France, became known to specialised circles, there was no hesitation in telling the story backwards: ‘As you may know, we began by developing solutions aimed at independent hotels, but we had several major chains asking to work with us: at PriceMatch, when we say that we want to democratise revenue management, we mean it!’ (Blog note, 17 September 2014).²⁷ According to a blog post (entitled ‘And 2005 will be Better...’), PriceMatch had more than 700 hotel clients at the start of 2015, 80 properties of which belonged to hotel groups; the overwhelming majority of the customer base therefore indeed derived from the independent hospitality sector. The start-up merged in December 2014 with its smaller counterpart PowerYourRoom, a company well established in Northern Europe, Germany, Austria, and Switzerland.²⁸ This rapid growth in activity was mainly financed—as mentioned above—by funds from a venture capital company and a hotel management and investment firm whose representatives sit on the start-up’s board of directors. In November 2013, PriceMatch received nearly one million euros from these firms.

The start-up runs on a sizeable budget—although no comparison to that of its Californian counterpart, Duetto, which, after three successive investment rounds,

²⁷ Behind these falsely candid discourses, the aim of PriceMatch’s managers was always in reality to conquer market shares in this sector, by offering their products and services to large hotel groups, both local and international. This is what comes out, for example, when reading the slides presented in May 2013 to the future investors: ‘We are mainly targeting 2*/3*/4* independent hotels located in cities, which are the most likely to be interested by our offer. This represents 5,570 hotels and 192,000 rooms in France for a total yearly sales figure of five billion euros. We have begun to take steps towards the private apartment rental market and in the medium term we are looking to sell the product to large hotel chains.’

²⁸ Linda Fox, ‘PriceMatch picks up PowerYourRoom,’ *Tnooz*, 23 December 2014 [online]. <https://www.tnooz.com/article/pricematch-picks-poweryourroom/> [Last consulted on 15 February 2017]

had already received in July 2014 a total amount of 33,2 million dollars²⁹—but which is limited by the imperative of high growth required by its investors. Nearly 70 percent of PriceMatch’s expenditure is spent on compensating its employees (68.6 percent, a third of which in the form of social security contributions).³⁰ Of this total, the supervisory cost is low (17.5 percent of the total payroll), the five founders receiving a monthly remuneration equivalent to the French guaranteed minimum wage (SMIC). The rest of the budget is divided among the other expenditure items, in more or less equal proportions, as follows: withdrawals from the current account (8.6 percent), business expenses and partnerships (6.4 percent), operating costs (6.2 percent), other costs (5.8 percent), and legal fees (4.2 percent). Equipment purchases are limited to the strict minimum, which explains the use of low-performance computer hardware that is sometimes ill-adapted (in particular to the needs of developers who are asked to come to the office equipped with their own laptops); likewise the chronic lack of certain equipment (the account managers use telephones at a rate that far exceeds supply, which comes down to four or five wireless appliances whose batteries run out too quickly, and regularly find themselves without one). At the height of these restrictions, when they have to travel, the salespeople and other representatives of PriceMatch barely ever stay at a hotel and prefer to use the online platform Airbnb for their business trips.

²⁹ Information obtained from CrunchBase [online]. <https://www.crunchbase.com/organization/duetto-research#/entity> [Last consulted on 15 February 2017]

³⁰ This estimate was derived from the income statement as of 31 August 2014, that is, ten months after raising capital.

‘At PriceMatch, There is No Hierarchy’

PriceMatch is located at 8 rue du Sentier, on the first floor of the north building of the Maison Mozart, in the heart of what has been known as Paris’s ‘Silicon Sentier’. Situated in the east part of the 2nd arrondissement, the area around rue du Sentier was once the stronghold of the textile and garment industry in Paris, but competition from emerging economies, especially China, drove the industry into near-bankruptcy. In the late 1990s, in the days of the Internet boom, many start-up companies set up in the area taking advantage of reduced rents and the quality of the telecommunication and Internet networks due to its proximity to the Palais Brongniart, the historical Paris stock exchange. Although the collapse of the dot-com bubble brought many of these companies to an abrupt halt, the area has since remained the preferred location for establishment of start-ups and incubators.

PriceMatch shares the premises with Kelkoo, a price comparison service and a French start-up which had its moment of glory in the early 2000s, culminating in its takeover by Yahoo! in 2004. There is no entry for ‘PriceMatch’ on the intercom; instead one has to press ‘Kelkoo’ to have the entrance gate opened. In the hallway a gloomy sheet of paper with the company’s logo and an arrow has been put on the wall to indicate the direction. To the left, Kelkoo and to the right, PriceMatch. Each company has its own independent space, but there is only one coffee machine and it is placed in the area occupied by PriceMatch. People of Kelkoo are regularly coming and going to grab a coffee. Most of the time though, the interaction between the two teams does not really go beyond casual greetings, except for one time, at the beginning of summer 2014, when Kelkoo organised live screenings of the FIFA World Cup and invited people from PriceMatch to come over.³¹

The place itself is not particularly impressive. It is a rather dark, open plan office with low ceilings, and a lingering odour of toilet. It is quite small—no more than 70 square meters, at a rough guess—especially for the twenty to thirty employees working in the start-up at the time. The narrow windows overlooking the courtyard do not let much daylight get in, hence the constant use of the cold, artificial light of neon lamps. The workplace is clean and well maintained but it is not very well ventilated and, despite air conditioning running at all times, the air is still and the heat is suffocating in the hottest afternoons of the summer.

³¹ Another example of ‘becoming closer’ is when people of PriceMatch tried to poach some female employees from Kelkoo.

The main room is T-shaped more or less and is overlooked by the ‘aquarium,’ a glazed meeting room in the colours of Kelkoo—white and orange—where Baptiste has taken up residence, sometimes joined by his inner circle, and from which he can observe the team at work. The floor is covered by a faded brownish carpet, which may need to be changed, as it has quickly been worn out by the back and forth of the swivel chairs. In the lower part of the ‘T,’ on the right as one enters, is the coffee machine mentioned above, providing dishwasher coffee and other hot drinks of the same genre—at least it is free—and, right after it, a door leading to a kitchenette and a toilet room.³² Against the west wall sit two tables with metal legs and a white top, each supposed to accommodate two people but rarely taken by less than four during working hours. On one of them sits the laser printer, which is almost exclusively used by Hanna, the accountant at PriceMatch, to output invoices. In the corner, a coffee table, on which lie a modem and two wireless phones—or at least their bases. It is surrounded by a hodgepodge of wires, a few empty boxes, some coats, an umbrella and a pair of sneakers. One could say it is some sort of cloakroom. In the middle of the room, a large table where employees eat at lunch time but which is certainly not big enough to accommodate everyone at the same time. On Mondays, it is used for the ‘Weekly Team Meeting.’ In the upper part of the ‘T,’ at the back of the room, two other long tables have been lined up, each accommodating eight people—and sometimes more. On the left are the developers and on the right the account managers. It happens sometimes that one or two developers sit at the account management table when ‘their’ place has been taken. The workstations have not been attributed beforehand and it is not unusual to see people changing place, should circumstances so demand. There is also trafficking of chairs going on—some supposedly more comfortable chairs being discreetly replaced by others—and computer screens. In the corner, on the account managers’ side, is a small fridge, mostly full of cans of beer that will be opened during the ritual ‘Beer Friday’. The walls are white and bare, except for a few shelves and a Magic Whiteboard stuck behind the developers on the north wall

³² It is recommended to leave that door shut at all times. Like a stinky fridge full of rotten food, opening that door releases the sickly smell of the sewer waste making the entire office smell like a toilet bowl. Most employees have long deserted this facility, choosing to go to the loo of the Quick restaurant or other bars in the area instead. When, in September 2014, PriceMatch moves to its next premises at the Partech Shaker, Baptiste proudly will confess to me: ‘For all the time we were there, I never once took a shit at the office.’

(and a calendar on the east wall). On this whiteboard are two things: first, what is used to being called in the start-up industry a ‘Scrum task board’, delineated by red tape and studded with yellow and green Post-it notes; and, on the right of the ‘Scrum’, is the remaining number of test customers to be made to pay by the end of the month, a number lugubriously called ‘Vendetta.’ Against the west wall, on the developers’ side, leans a paper board on which a list of PMS has been drawn up. There are four or five cabinets, each is stuffed with files and an odd assortment of arbitrary items: a clutter of boxes, folders containing the hoteliers’ contracts and assorted paperwork, office equipment, unused computer screens, laptops, phones, and other electrical appliances, a few alcohol bottles and some plastic glasses, a football, Carine’s fork, and two books—*The Strategy of Conflict* by Thomas C. Schelling and *Poor Economics* by Esther Duflo and Abhijit V. Banerjee. Perched on top of these cabinets: a screen displaying the platform’s performance in real-time, two trophies gathering dust—PriceMatch was awarded a special prize at the *Innovact* competition and the first prize of the *Concours national de la création d’entreprise*—and, again, empty boxes. All this typical office furniture was already there when the team arrived. One personal touch though: Julien has fitted an electric, height adjustable standing desk for his own use against the north wall, between the developers’ and the account managers’ tables. Other than that, there are some other cardboard boxes here and there, a lot of chairs, and nothing more really.

All in all, the equipment consists of four or five wireless phones, several computer screens, including a large monitor in the meeting room, a few desktop computers and laptops, and a printer, as I have already mentioned. Expenses are frugally managed at PriceMatch—at least for cost items like equipment—and no more than what is needed to get the work done is purchased. The several Google Chromebooks bought by the management because of their relatively low prices are often subject to mockery from the developers. Most of the latter ‘prefer’ to bring their own personal laptops with them but are provided with an extra screen to work on. ‘Frugally managed,’ in this case, certainly does not mean ‘efficiently managed.’ Indeed, it is common to hear account managers complain about the lack of phones in the room, and they often have to join a queue to lay hands on one of them, even though a large part of their work is to be done by phone. The problem has gone from bad to worse by the end of the afternoon when all the batteries have gone flat.

It is the same situation at the Sales office.³³ When all the phones have been taken, some telemarketers are asked to use their own cell phone to make their phone calls—in this respect, the account managers are lucky that the network is so poor in their office. The shortfall and deficiency of certain implements is a well-known problem at PriceMatch but it is slow to be alleviated, I think, less due to lack of means than lack of time and above all because no one in the company seems to feel responsible for this state of affairs.

³³ A month or so before I arrived at PriceMatch, the sales team office was relocated to 19 rue Pierre Lescot in Les Halles district—one metro station away from the head office—because of lack of space but also, I was told, because the racket that the salespeople were making on the phone was getting on the nerves of the rest of the team. The premises are a renovated Parisian apartment, shared with Randco, an IT infrastructure services company. The salespeople of PriceMatch have their own room, with a desk accommodating seven workstations, and can also make use of a conference room, most of the time occupied by Adil—although he has his seat at the head of the table in the main room—and his seconds in command, Alexandre and Basile. It is bright, clean and quite simply nice in comparison to the Sentier premises.

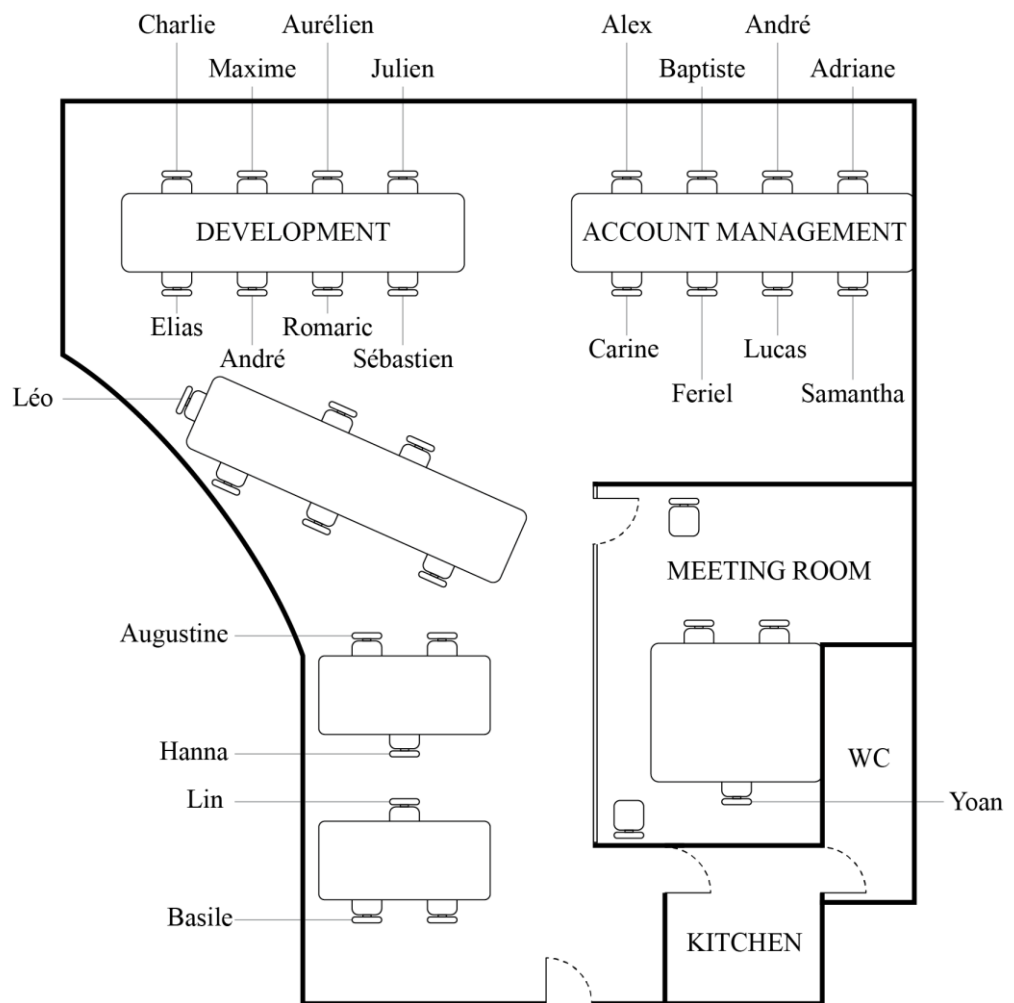


Figure I.1.1. Plan view of the main office, rue du Sentier (Field notes, 31 July 2014).

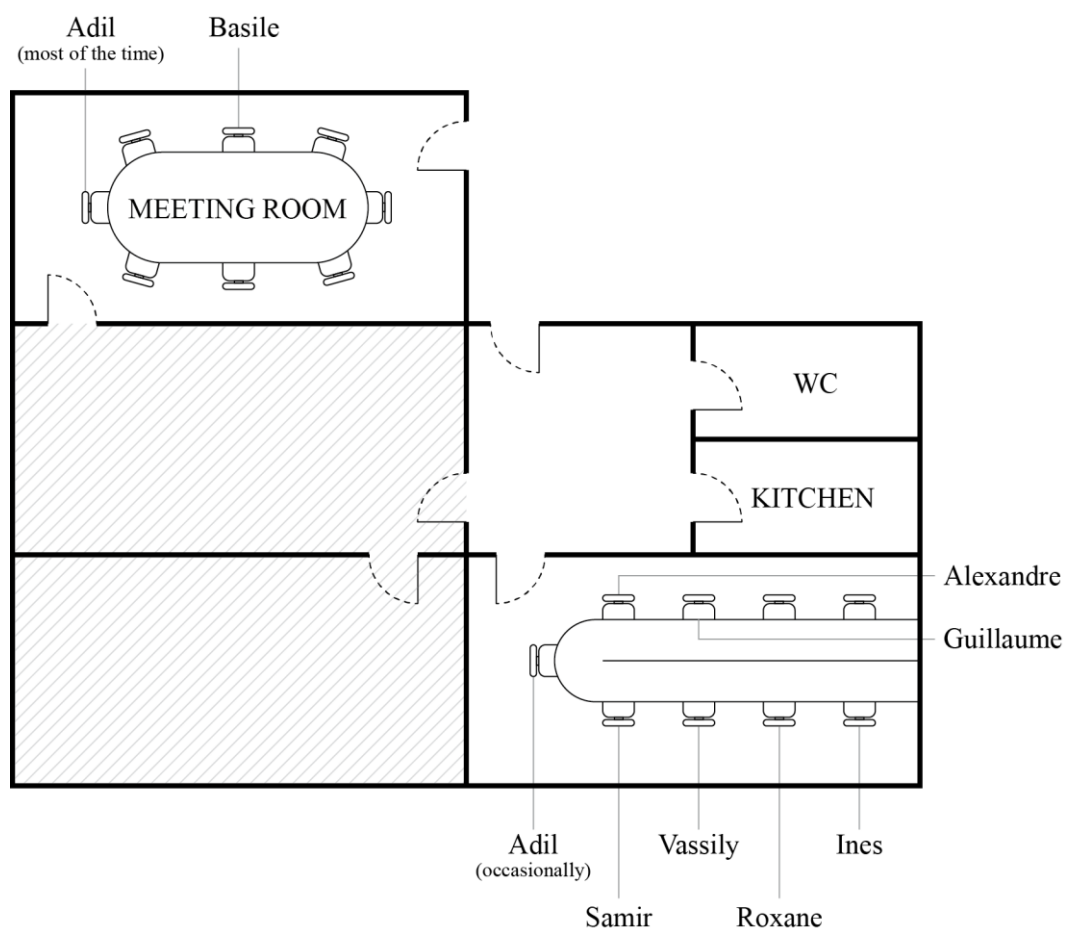


Figure I.1.2. Plan view of the sales office, rue Pierre Lescot (Field notes, 12 June 2014).

In both its layout and arrangement, the room presents itself as a resolutely associative³⁴ work space through the absence of closed offices, both for employees and directors. These are considered to be a luxury that only large firms can afford.³⁵ There is no clear-cut separation between those who organise work and those who execute it: the founders demonstrate their willingness to serve as an example by choosing to work in an open plan in the middle of their teams, even with no assigned workstation—the allocation of places and composition of teams can evolve from project to project. Should the need arise, they may join in with almost any task, even the least pleasant ones. This was evidenced by the involvement of the start-up's President in the commercial effort when, one afternoon in July 2014, he sat down at the telemarketing team's table and made a few phone calls with them.

There are no fewer than six desktop computers in the room, placed for the most part at the account managers' table. The other staff members make use of a laptop, either lent by the company or their own one, which encourages everyone's mobility in the work space, fosters communication, and enables the formation of multiple *agencements*.³⁶ However, it is less the number of associations than their nature that gives this sort of spontaneous and shifting scenography its full power

³⁴ Bruno Latour, *Reassembling the Social. An Introduction to Actor-Network-Theory*, Oxford, Oxford University Press, 2005.

³⁵ Indeed, if open workspaces are largely widespread in large groups, it is often employees who occupy them, whereas the individual office model remains the norm for the management. Catherine Quignon, « Des bureaux collectifs pour les salariés... pas pour les dirigeants », *Le Monde économie*, 20 February 2017.

³⁶ This comment by Karen is typical on this count: 'I particularly see the differences [between a large firm and a start-up] in terms of internal communication. When you're in a big firm and send an email to someone you don't know, that you might never meet, you're going to be a lot more formal in the way that you write. In a start-up, at least this is what I do, you first go and speak to the person, then, if necessary, write an email to get extra information, get a written trace so that it can be forwarded to someone else, etc. So yeah, there's a lot more oral communication and it's more immediate, so you end up getting results much quicker than in a company. My impression is that people are far more reactive in a start-up than in big companies.' [*Interview, 29 May 2015*]

and meaning. It is noteworthy that each team at PriceMatch includes one or several founding members, generally placed *at the end* of the table. This physical proximity suggests a quasi-equivalence link in terms of hierarchy between the factotums of the new economy, who work long hours for relatively low wages, and the founders, who will share between them considerable sums at the moment of the sale of the start-up. The idea is thereby given, concretely, that ‘at PriceMatch, there is no hierarchy,’ as explained by Karim, who very much appreciates this kind of organisation: ‘I think that being able to speak freely like that to Baptiste or another company-founder is really good. To be able to speak to Adil, work in a group together with no hierarchy, it’s important. Without that I would never have felt so involved, I wouldn’t have stayed.’ ... ‘Yeah, I wouldn’t have liked there being a hierarchy. I don’t like hierarchies.’

The start-up is not simply the site of a zeal and intense work; it is also the support of a form of ‘sociability’³⁷ that goes well beyond the walls of the organisation. The start-up members are not colleagues only, but become office- and playmates, almost relatives.³⁸ Besides, many were friends or classmates before working together. Some have chosen to live in house share. This is the case of Baptiste and Léo. The cofounders reside in a large house in the heights of Ménilmontant, in the 20th arrondissement of Paris, in which they regularly organise parties where all the people of PriceMatch are invited. On weekdays some members meet after work in the bars in Grands Boulevards or Strasbourg-Saint-Denis to have a drink and to play pinball and table football. The start-up appears as the place of a complete relational isolation and a sociality in a vacuum. The shared foundation of values is, hence, is all the more guaranteed that individuals often see their social network merging into one, which revolves around the start-up. Politics is rarely

³⁷ Georg Simmel, ‘The Sociology of Sociability,’ *American Journal of Sociology*, 55, 1949, p. 254-68.

³⁸ The reference to kinship between those individuals who develop in the start-up ecosystem can be found down to the name of the French seed accelerator, TheFamily, created at the end of 2013 and situated in the 4th arrondissement of Paris.

touched on.³⁹ Social issues, such as youth unemployment and precarity, are occasionally broached during the interviews that I have conducted (even though almost a quarter of the start-up members are employed as casual workers). Only easily assimilated information such as sporting events (the FIFA World Cup, which took place from 12 June to 13 July 2014, was of course the subject of long discussion; especially the successful campaign of Algerian team in the championship was much commented by some of the passionate supporters) or miscellaneous news items (for example, those three air disasters in a row which occurred in the space of one week only in July 2014) are automatically given centre stage. The brunt of small talk at the coffee machine are about the activity itself; advice and tips on sales arguments or on how to write a line of code are traded; calls and appointments with hoteliers are analysed (especially those that went well); often the debates focus on business creation, the perpetual problem of start-up financing and assorted technicalities; information on the pending contract with Accor and the fundraising round to come.

The extent of the management team and their quasi-omnipresence in the room play a significant role in the establishment of hierarchies within the start-up: there are no fewer than five founders, plus the same number of directors, all dedicated to the company's success, in particular because they may own shares in it. Both a work post and an observation post, the location the latter hold in the work place is a site from which they can in a single glance embrace, supervise, and thus control the entire scope of undertakings, tasks, ideas, even leisure, which each of the employees takes an interest in and takes part in. 'One morning,' Cédric tells me, 'Nicky was causing trouble, he'd come into Stéphane's and my office and spent 20 minutes ripping into Julien [*one of the cofounders*], saying that Julien had an inferiority complex with the rest of company. Elias [*another cofounder*] heard Nicky coming out with all this from the toilets, and came in and snapped "I think

³⁹ This note of 18 July 2014 is one notable exception: 'After Samir left, we find ourselves in a small, intimate group, and Adil takes advantage of the opportunity to hail us [Alexandre and me] about the Israeli-Palestinian conflict. The day before, Israeli command decided, as part of the "operation protective edge," to send ground troops into Gaza Strip with the stated aim of destroying the tunnel system used by the Hamas members.'

you've got better things to be doing than talking and you've certainly got work to do".'

Proclaimed enemy of the vertical and partitioned hierarchy of large companies, the start-up does not actually suppress any notion of hierarchy; it steers the action of its members according to an authority principle which is less bureaucratic than personal. This is what Max Weber has called 'charismatic authority' [*Charismatische Herrschaft*], the type of authority that derives from the charisma of the leader, in this case the leaders, which, although with a rational-legal basis, depends upon the qualities of the person rather than the role.⁴⁰ This is because of the unspoken code according to which members of the start-up must be esteemed in the light of their competences and abnegation, and regardless of any account of their level of study nor even their status in the company. Everything takes place as if a certain ethic governed interpersonal relations and ruled out any leadership which would be far too reminiscent of that of a supervisor in a large company liable to threaten this 'wholly personal devotion' to the founders, hamper the smooth functioning of daily individual exchanges, and thereby endanger the specific hacker subculture that the start-up perpetuates.⁴¹ According to this ethic, notably, the importance of educational capital should not be exaggerated. The subject of educational rankings, such as university and college rankings or the individual ranking obtained in a competitive exam (*concours*), is occasionally broached but it

⁴⁰ Max Weber, 'Politics as a Vocation,' in Hans H. Gerth and C. Wright Mills (eds.), *From Max Weber: Essays in Sociology*, New York NY, Oxford University Press, 1946, p. 77-128.

⁴¹ 'Mistrust authority—Promote Decentralization,' proclaims Steven Levy, who developed in 1994 a hacker ethic. 'Hackers should be judged by their hacking, not bogus criteria such as degrees, age, race, or position.' Steven Levy, *Hackers: Heroes of the Computer Revolution*, Sebastopol, O'Reilly, 2010, p. 29 and 31. On this new working ethic which would oppose to the protestant ethic as defined by Max Weber, see Pekka Himanen, *The Hacker Ethic and the Spirit of the Information Age*, New York NY, Random House, 2001 (with a prologue by Linus Torvalds and an epilogue by Manuel Castells). One can also find a monographic study of a hacker community in California in Michel Lallement, *L'Âge du faire. Hacking, travail, anarchie*, Paris, Le Seuil, coll. « La couleur des idées », 2015.

is almost always with the aim of undermining their legitimacy to achieve a positive hierarchy within the organisation. ‘They really have recruited well’, reckons Cédric about his colleagues of the engineering team. ‘In terms of qualifications, it’s difficult to know because they’re all Polytechnique graduates [*polytechniciens*]. For example, Marco, who left, wasn’t as good as the ones who stayed. Maxime really is better than we could have known when he was recruited.⁴² He’s just incredible. He’s involved in everything. He knows his way around any kind of coding. He gives advice to everyone (even Elias, despite the fact that Elias is a Partner). Elias isn’t as good at code as the rest of them. He’s not as good as Maxime, Romaric and Aurélien. Romaric is just so so good. Like, super intelligent, literally incredible. Aurélien, he really fits in well, very productive, very efficient, very good. And Julien, he’s a guy that already knows everything about PriceMatch and can hold huge amounts of information. He’s the big boss, he really is top quality.’ What matters most are individual and technical qualities, through which a cofounder proves himself worthy in the eyes of his employees of exercising a form of authority; these qualities are superimposed on the formal authority which is conferred by his position in the organisation chart. But if this transfer does not occur, no authority will be recognised and conflicts may break out, as indicated in the following anecdote, again told by Cédric, of his time spent at PriceMatch in summer 2013:

One time I had a problem with Elias. ... He was getting on my nerves, it was the evening and there was a problem with the PMS of a hotel that had been going on for a few weeks. He had decided that I should call them that evening. Firstly, I hate using the phone. Second, I’d already decided that I was going to head off, so whether I called or not tonight would make no difference because it was 6:30. Instead of calling, I decided to send an email. I was sat next to him, so basically when he saw the email, he said ‘but I told you to call them, so you call them.’ The tone he used was really unpleasant. I told him ‘OK well if that’s how it is, I’m off.’ (Interview, 11 September 2014)

⁴² Maxime is a graduate of Télécom ParisTech. He is one of the few engineers who did not go to the Ecole Polytechnique.

This example helps illustrate what happens when the criteria of judgment and goals are not shared and that legal authority is not recognised. Elias, as a cofounder of PriceMatch, would have legal authority to command, but Cédric does not recognise it. The problem is not merely of a technical nature; indeed, Cédric deplores an authoritarian attitude which comes across to him as dissonant with the way in which power should be exercised within a start-up:

I really love working with Léo, that's the reason I stayed. ... With Léo, I'm at ease, I can make jokes as much as I want. I don't say to myself 'he's the boss' or whatever. It's really nice. By contrast, I've never really had a great connection with Elias, who kind of likes being the boss. ... For me, it's normal to have a friendly relationship with the guy who's directly above me. That's how I perform best; when I want to prove to the guy above me that I'm worth it, that there's an intellectual relationship there. It's about showing him that I'm intelligent and not just thinking to myself 'if I don't work I'm going to get told off, so I'm going to work like crazy.' That's why I don't want to join a big company where I'll be put into really frustrating situations every day that just don't work with my personality. (Interview, 11 September 2014)

The critique of the start-up slides quietly into another well-known theme, that of the big company, with its strict hierarchy, impersonal relationships and people-management strategies based on coercion. Under this angle, the room functions in the manner of a stage on which each can offer proof of his or her excellence in manipulating the group's particular technical capital, namely technological mastery and knowledge of programming and data processing.

Placement at PriceMatch is highly normalised. The order of the occupants, the materials they have, the position, the location they hold in the confined space of the room, all map out a complex and finely hierarchized structure. A strict order governs who occupies what chair at each table: it is the founders and the experienced staff who have precedence. They are most often placed at the end of the table. Next come the employees, in rough order of seniority, expertise—undoubtedly—but also affinity, followed by the interns and other temporary workers. For example, at the salespersons' table, in descending order of authority: Adil, sales director and cofounder; Alexandre, crack salesman and close friend of Adil; Samir and Roxane, other salespeople who joined the company more recently;

the interns (Guillaume, H  l  ne, L  a, myself, etc.) who succeed each other in telemarketing jobs at a frantic pace. Likewise, at the account managers' table, team head Feriel has taken care to place at her side trusted people: on her right, Lucas, one of the first PriceMatch employees, and, on her left, Carine, intern but student in the same business school as her—'my only two friends at PriceMatch', she confided one day. The meeting room is reserved for the management. Its main virtue is to be sound-proof, and thus to offer a space relatively isolated in which professional confidentiality, personal confidences, even useless meetings and pointless chats are permitted—in particular it is in this place that the executive committee, or 'Comex', gets together to decide the company's strategic orientation. Officially, it is open to any staff member, who may need it for diverse motives, for example a group meeting or welcoming a person external to the start-up. But in reality, it is almost always occupied by Baptiste, who has made it *de facto* his personal office—only Yoan, head of partnerships, allows himself to use it from time to time, and even that happens more often than not when the president is not present.⁴³ The need for confidentiality cannot hide the social reason behind the quasi-permanent occupation of this place: the meeting room materialises Baptiste's place and function in the organisation; it is the site of his authority (likewise, at the office at the Halles, Adil spends most of his time in the calm of *his* meeting room).

The importance of this seemingly trivial scenography should not be underestimated. Indeed, it is one of the essential elements of the ideology of the new economy: it communicates in a latent and physical way to the members of the organisation the values and categories of understanding of the universe of start-ups, the very ideas which oppose to the culture of the large firm—namely, a blending of 'fun' with the group and individual 'serious',⁴⁴ devotion and relentlessness in work,

⁴³ When not in the meeting room, Yoan retreats to the entry hallway where he has arranged some sort of a private office in the corner, with a stool and a coffee table—a habit that he will not give up when PriceMatch settle in the spacious and comfortable premises of the Partech Shaker.

⁴⁴ Here I borrow the indigenous categories developed by the president and founder of Blablacar in « Fr  d  ric Mazzella, l'ADN de la r  ussite ! », *Manager & r  ussir*, 8, 2015, p. 10-13.

a pronounced sense of the dynamism of youth and spontaneity in action, and an emphasis on genuine competences rather than degrees and diplomas and independent learning.⁴⁵ Surreptitiously, the physical setting supports the belief in a redistributive ideal between the members of the start-up and contributes to maintain the illusion of a real and concrete equality of everyone, whereas the social organisation of the company and its structural logics rather indicate that clear distinctions do exist—in particular with regard to access to management positions, which bring both social recognition and monetary wealth (via the shares in the company that they give right to), and which are tightly controlled by the cofounders and investors and reduced as much as possible.

⁴⁵ Olivier Marty, *La vie de start-up : Investir et S'investir dans une entreprise innovante*, Master thesis, Paris, École Normale Supérieure and École des Hautes Études en Sciences Sociales, 2001; Olivier Marty, « La vie de start-up. S'investir dans les entreprises innovantes », *Gérer et comprendre*, 67, 2002, p. 4-15.

2. The ‘Dot-Com Kids’

It is well known—in particular since the work of the American sociologist Howard Aldrich⁴⁶—that the overwhelming majority of business creation comes from groups of entrepreneurs and that the teams constituted are quite homogeneous. Thus, in France, several recent studies on start-up founders showed that only a quarter of these so-called ‘innovative’ companies involve one founder—with an average of a little more than two persons involved, founding team size ranges from one to six people.⁴⁷ Contrary to the widespread image based on the native myth of the ‘solo

⁴⁶ Using a nationally representative sample of organisational founding teams, Martin Ruef, Howard Aldrich and Nancy Carter found that about half of all efforts to found a new business involve teams of two or more people, with the rest being solo efforts. They also tested for the operation of five mechanisms affecting the composition of entrepreneurial groups and found especially strong support for two mechanisms that influence group composition: homophily in respect to both ascriptive and achieved charter (e.g. gender, ethnicity, and occupation) and network constraints imposed by strong ties. Martin Ruef, Howard E. Aldrich, and Nancy M. Carter, ‘The Structure of Founding Teams: Homophily, Strong Ties, and Isolation among U.S. Entrepreneurs,’ *American Sociological Review*, 68 (2), 2003, p. 195-222.

⁴⁷ Jean-François Barthe, Nathalie Chauvac, and Michel Grossetti, « Entrepreneurs de circonstance : une enquête sociologique sur les fondateurs de start-up en France », *Revue de l'Entrepreneuriat*, 15 (3), 2016, p. 163-80. This article is part of a series of papers which derived from a survey conducted between 2005 and 2014 on 97 ‘innovative’ companies based in various urban areas of the South of France, namely Toulouse-Castres-Tarbes, Bordeaux, Grenoble and Marseille; see Michel Grossetti and Jean-François Barthe, « Dynamique des réseaux interpersonnels et des organisations dans les créations d'entreprises », *Revue française de sociologie*, 49 (3), 2008, p. 585-612; Fabien Reix and Michel Grossetti « Parcours biographiques et carrières entrepreneuriales », in Pierre-Marie Chauvin, Michel Grossetti, Pierre-Paul Zalio (eds.), *Dictionnaire sociologique de l'entrepreneuriat*, Paris : Presses de Science Po, 2014, p. 413-32. On the composition of entrepreneurial groups in France, see also Philippe Mustar, ‘Partnerships, Configurations, and Dynamics in the Creation and Development of SMEs by Researchers: A Study of

entrepreneur’, and on which public authorities tend to adjust support measures for business creation,⁴⁸ setting up a start-up does not generally rest upon the individual efforts of a heroic and visionary entrepreneur but rather on a collective action carried out by individuals who are alike. This cooperation, or if one prefers, this association of entrepreneurs, which tends de facto to *homophily*,⁴⁹ operates not in the seemingly rational choice of a complementarity of profiles but rather according to a logic of similarity, mitigating the uncertainty through trust and intimacy.⁵⁰ It would be difficult to overstate the influence of friendship ties that the partners had built before the creation of PriceMatch: Baptiste, Léo and Julien have been friends since high school; Baptiste, Adil and Timothée met at Sciences Po; Léo, Julien and Elias are from the same cohort at Ecole Polytechnique (see Figure 3). Julien explains that, with regard to the decision to grant Elias cofounder status and with it a sixth of the shares of the start-up, ‘there was no real question. We had a discussion and said: “he has insight, he’s well integrated into the team, *he’s cut from the same cloth as us*. It would be absurd for him to be different, not have the same status as us”.’

Academic Entrepreneurs in France,’ *Industry and Higher Education*, 12 (4), 1998, p. 217-21.

⁴⁸ Martin Giraudeau, « Le travail entrepreneurial, ou l’entrepreneur schumpetérien performé », *Sociologie du travail*, 49 (3), 2007, p. 330-50.

⁴⁹ Martin Ruef, Howard E. Aldrich, and Nancy M. Carter, ‘The Structure of Founding Teams,’ *art. cit.*

⁵⁰ This finding proves to be true in the case in point as well, but at the initial stage only. In the summer of 2012, the issue of the non-complementarity of profiles among the cofounders was raised. According to Léo, it had become a necessity to integrate new partners, with advanced skills in programme writing: ‘I was the only one with a technical background (Baptiste did a bit of econometrics but I was the one with the most technical experience). And it was a little bit bizarre to have four partners with only one having a strong technical background. That’s why we brought Julien on board (first he helped out sporadically, then we offered him cofounder status) and then Elias, who started as an intern before we offered him cofounder status too. We wanted to up the technical expertise in the team.’ (Interview, 24 September 2014)

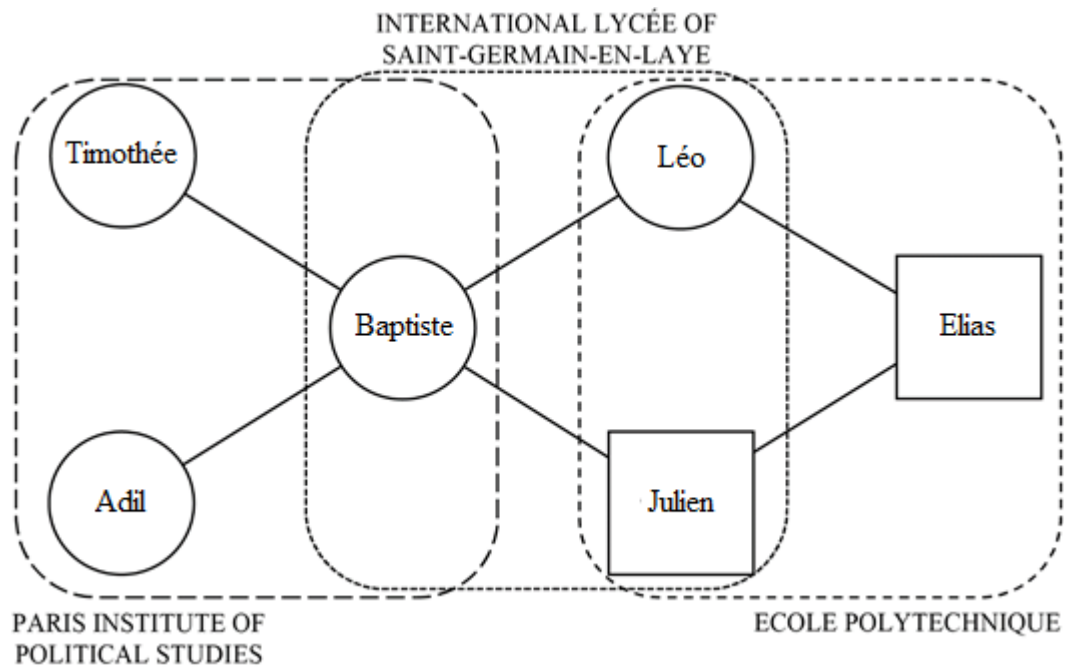


Figure I.2.1. Sociogram of the founding team.

Note—The first members of the founding team are represented by circles; those who joined later are shown by squares.

The configuration of the sociogram thus drawn can be referred to, in the terminology of Jacob L. Moreno, as a star.⁵¹ This gives an indication on who is likely to lead the company: due to the central position they occupy in the sociogram, Baptiste and—to a lesser extent—Léo can aspire to power. During the summer of 2014, when I conducted my participant observation, the most prestigious positions were indeed given to Baptiste and Léo who were respectively President and Chief Technical Officer (CTO). A clique can also be identified, as Baptiste, Léo and Julien form an exclusive group of high school friends. It is therefore expected that they benefited from a better access to information compared to the other members of the management team. This may help to understand too why the group did not collapse when Timothée left the company to enter the Ecole nationale d'administration (ENA) at the end of 2013. This resilience can certainly be explained by Timothée's relatively isolated position in the sociogram.

⁵¹ Jacob L. Moreno, *Sociometry and the Science of Man*, New York NY, Beacon House, 1956.

However, what is remarkable is the quasi-absence of any empirical studies in contemporary sociology on the social origin of those, founders and other employees, who work in start-ups.⁵² Note that one can get a preliminary idea by surveying the annual diversity reports of large high tech firms of the Silicon Valley. And evidence from biographies and native accounts suggests that the workers of the new economy come from economically and socially advantaged segments of society. Interviewed by reporters of the French version of the magazine *Slate*, Kourosh Davarpanah, president and cofounder of the start-up Inato, points out: ‘I have the impression that in France there is a lot more government help than in the US, but nevertheless, start-up founders come from pretty wealthy backgrounds.’⁵³

It is important to stress, however, that this selection (and self-selection) of start-up founders operates less via the constraint of access to monetary means than through the mediation of specific cultural capital, as Pierre Bourdieu would put it,⁵⁴ that is within reach of these most educated fractions of the French elite. In point of fact, there is not much of a direct economic barrier to start-up creation to speak of: the fee to be paid to register a SAS—the preferred status of start-up founders—in the trade and companies register amounts to 50 euros and the law requires no minimum amount of share capital.⁵⁵ Likewise, accommodation in an incubator is often a free service, at least over an initial phase (at the Sciences Po incubator,

⁵² An exception is the book of Gina Neff (*Venture Labor. Work and the Burden of Risk in Innovative Industries*, Cambridge, MA: MIT Press), published in 2012, on the career trajectories of high-tech workers in New York City’s ‘Silicon Alley’ in the 1990s.

⁵³ Jean-Laurent Cassely, « Start-ups: comment la bourgeoisie française a rattrapé la transition numérique », *Slate*, 19 April 2016 [online]. <http://www.slate.fr/story/116817/bourgeoisie-francaise-transition-numerique#texte> [Last consulted on 15 February 2017]

⁵⁴ Pierre Bourdieu, ‘Forms of Capital’, in John G. Richardson (ed.), *Handbook of Theory and Research for the Sociology of Education*, New York, NY: Greenwood, 1986, p. 241-58.

⁵⁵ Notwithstanding this, the partners of PriceMatch had initially chosen to invest the sum of 2,000 euros each.

where the PriceMatch team resided for over a year and a half, an annual fixed sum of 12,700 euros⁵⁶ was requested from the moment a start-up had benefitted from funding from the City of Paris)—although the living expenses of the founders, who did not pay themselves before October 2013, required sufficient and stable financial resources. Young persons in a less advantageous position are also eliminated because they lack the ‘cultural habitus’ demanded by the entrepreneurial profession: canvassing the first customers, managing teams and above all convincing investors require de facto a certain social comfort, a capacity to speak in public, a way of being and saying that can take root only in particularly favourable social and economic conditions. Below a certain threshold of ‘incorporated cultural capital,’ one is highly unlikely to acquire the bodily and moral dispositions that are indispensable if one is to successfully carry out this activity.

31 March 2016, I have a discussion with one of the investors (who wanted to remain anonymous) who took part in the fundraising for PriceMatch, and ask about the reasons which led him to bank on this start-up:

‘It was Baptiste who first came to present the product to me. And yeah, I had a good feeling about it. We got on well, and he told me that they were currently looking for investors. I said that I could potentially be interested... I know the market, and I knew that their product had a niche. I could see that Baptiste had a personality that would make the whole thing a success. They had the three essential criteria, so I invested in the first round.’

‘Can you clarify those three criteria?’

‘The management, the product, and the market.’

‘You mentioned Baptiste’s personality...’

‘Yes, I think that Baptiste has the ability to charm, to sell, to convince. You know, it’s the personality of the boss that makes or breaks a company.’

Preliminary analysis of the profiles of the 34 members (with a median age of 25 years old, the maximum being 58) active in the summer of 2014 at

⁵⁶ This price falls to 6,350 euros for start-ups nurtured outside the incubator.

PriceMatch⁵⁷ confirms that start-up workers stand above the upper tier of the higher segments of the working population in employment in France. Two thirds of them (66 percent) had fathers in executive jobs or intellectual professions, 3 percent had fathers in intermediate occupations and 22 percent had fathers who were sole traders, craft or related trade workers. The remainder were either clerical, blue-collar workers or farmers (16 percent). Twenty-three of the PriceMatch members (or 68 percent) had entered a French *grande école* (Ecole Polytechnique and Sciences Po, where the founders studied, are by far the most represented in the start-up, with 21 and 15 percent respectively, although also present are other business schools such as the ESSEC and EM Lyon, as well as engineering schools, like the Ecole des Ponts ParisTech, Télécom ParisTech, Arts et Métiers Paris Tech, and CentraleSupélec); one member had earned a master degree at university and five others a bachelor. Only five (or 15 percent) had undergone vocational training at the level of ‘Bac+2.’⁵⁸ For the purposes of comparison, of engineers, executives, and intermediate occupations in the private sector under 36 years of age in 2014, 34 percent had fathers in executive jobs or intellectual professions and 54 percent of their fathers were clerical or blue-collar workers or farmers; 54 percent of this group had obtained a diploma from either school or university at bachelor-level or higher, and 21 percent had not completed higher education. The educational and socioeconomic status of start-up workers is thus quite a bit higher than that of the average worker in France.⁵⁹

⁵⁷ A questionnaire survey was conducted in the start-up during the summer of 2014. It provided standardised responses which can be subject to quantitative analysis: 34 people replied to the questionnaire (of the 38 members of PriceMatch at the time), that is, a response rate of 89 percent—see Appendix B.

⁵⁸ In fact, most of the start-up’s members reproduce a school capital already accumulated by their parents, as half of their fathers received Master or Doctorate degrees and only 16 percent of them left school without graduating from secondary education.

⁵⁹ Some recent empirical studies conducted in these markets have shown that the high-tech entrepreneurs who start high-technology ventures have significantly higher education than the entrepreneurs who start low-technology ventures in traditional industries. For empirical studies on this topic, see Ayala Malach-Pines and Mustafa F. Özbilgin (eds.), *Handbook of*

Furthermore, although the information on the issue is fragmentary and not easy to find, the social recruitment of start-up workers tends to rise slightly as one climbs up the hierarchy of the organisation. Indeed, the work of economists indicates that the majority of business starters come from an affluent background. This is particularly true of these ‘incorporated’ companies that most closely resemble start-up businesses.⁶⁰ The upsurge in the digital sector over the past decade of graduates from *grandes écoles*, in which new entrepreneurial training and incubators have been created, should make it clear that start-up founders do belong to these groups situated at the top of the class ladder. It may also be recalled the considerable influence of the family environment on educational success in France: according to figures of the Ministry of Education for the 2014-15 school year, children of executive and intellectual workers were eight times more likely than children of blue-collar workers to attend the *classes préparatoires* and *grandes écoles*, holding alone half of the places in these most selective courses. They only

Research on High-Technology Entrepreneurs, Northampton, MA and Cheltenhamand: Edward Elgar, 2010.

⁶⁰ On the specific influence of social background on entrepreneurial process, see David Branchflower and Andrew Oswald, ‘What Makes an Entrepreneur?’ *Journal of Labor Economics*, 16 (1), 1998, p. 26-60. More recently, the working paper of Ross Levine and Yona Rubinstein, ‘Smart and Illicit’ (subtitled ‘Who Becomes an Entrepreneur and Do They Earn More?’, NBER Working Paper, 19276, National Bureau of Economic Research, August 2013) proposed to go beyond the social determinants (race, gender, schooling, and family background) usually retained in such studies and showed that it is actually a combination of smart, which the authors measure as learning ability where people in the survey are given exams when they are teenagers, and their willingness to bend and even break the rules and engage in aggressive risk-taking behaviour, which is measured by an index of the degree to which they engage in illicit activities before they entered the workforce, that predicts both entry into entrepreneurship and the comparative success of entrepreneurs—some thought-provoking findings that seem to suggest that the *real* difference between founders of tech start-ups and crack dealers is that the former come from wealthy families.

represent 15 percent of the French population.⁶¹ Thus, during the 2016 edition of the Consumer Electronics Show (CES), the Conference of *grande écoles* (CGE)⁶² established that, of the 190 French start-ups present in Las Vegas, more than four in five founders (83 percent) had graduated from a *grande école* in their principal curriculum (79 percent) and or complementary curriculum (64 percent).⁶³ By way of local confirmation, it should be noted that, of the five members of the founding team of PriceMatch, all obtained their principal degree in a prestigious *grande école* and three of them attended the secondary school of the ‘golden immigration,’⁶⁴ the international lycée of Saint-Germain-en-Laye, where they met. Nearly all are white,

⁶¹ It would probably be of interest to try to understand the phenomenon of substitution that some commentators have observed in France (see, for example, Jean-Laurent Cassely, « Start-ups », *art. cit.*), through which well-off people seem to have taken over a business sector initially occupied by workers who are less privileged, thus transforming the economic and social composition of this economic space to the exclusive benefit of the economic and intellectual elite of the country, while, at the same time, the public authorities have reinforced their support to the creation and development of innovative companies. Such a process of ‘sectorial gentrification’ may be comparable to those observed in other main start-up ecosystems in the world, such as the San Francisco-Los Angeles area, New York, Boston, London, and Tel Aviv.

⁶² Conférence des grandes écoles, « Bilan du CES de Las Vegas : 83% des fondateurs de start-up formés dans les Grandes écoles (Étude Conférence des grandes écoles) », Press release, 28 January 2016.

⁶³ In its annual survey on occupational integration of graduates of *grandes écoles*, the CGE confirms that entrepreneurship as a job prospect progresses from year to year: in 2016, 4 percent of these students created their business upon leaving school, versus 3.5 percent in the previous year. It is noteworthy that this statistic does not take into account all those who came to work in a start-up, who are also more and more, and those who will embark in entrepreneurship after a brief call on a large firm. Conférence des grandes écoles, « Enquête insertion CGE 2016 : nette embellie pour l’insertion professionnelle des diplômés des grandes écoles », Press release, 15 June 2016.

⁶⁴ Anne-Catherine Wagner, *Les nouvelles élites de la mondialisation : Une immigration dorée France*, Paris, Presses universitaires de France, 1998.

male, and come from higher-income families—with the one exception of the son of a blue-collar worker of Moroccan origin.

The start-up workers, then, do not belong to that new proletariat in the vanguard of the revolution, the hope of which fed by the very theoretical discourses—abstruse in many ways—on the consolidation of a ‘cyborg’ class supposedly independent of ‘the machinations of capital.’⁶⁵ Instead, everything tends to indicate that most of them differ from other young employees thanks to their additional economic resources, and that they come from traditional middle-class background and are attempting to maintain their social status by entering a profession that they perceive as a ‘real job,’ highly regarded by their immediate entourage, which furthermore offers the prospect—if only for a minority—of big financial earnings. Many of their fathers work in an ‘economic’ job, as a commercial agent, computer engineer, director of a communications agency, general contractor, baker, or lawyer, general practitioner, chemist, journalist or even painter. Many of them have a learned profession (9 percent), are executives in the private sector (28 percent) or heads of a company (22 percent) and a good number of them (44 percent) are self-employed or are employed in their own business. Perhaps most distinctive about their background is that nearly all of their mothers had access to paid employment and most of them (53 percent) held executive or intellectual occupations. To be sure, a contingent of start-up workers comes from the lower fractions of society, but they are not the majority; nor are the start-up founders issued from the working class those who are the more successful in the medium run.

The headcount of PriceMatch increases markedly from one month to the next, and this in spite of the many departures. So: in May 2014, there were 22

⁶⁵ Jeremy Rifkin, *The End of Work: The Decline of the Global Labor Force and the Dawn of the Post-Market Era*, New York, NY: G.P. Putnam’s Sons, 1995; Michael Hardt and Antonio Negri, *The Labor of Dionysus*, Minneapolis, MN: University of Minnesota Press, 1994. For a critical review of these books, see Georges Caffentzis, ‘The End of Work or the Renaissance of Slavery. A Critique of Rifkin and Negri,’ in *In Letters of Blood and Fire. Work, Machines, and the Crisis of Capitalism*, Brooklyn, NY and Oakland, CA: Common Notions, PM Press, 2013, p. 66-81.

members in the team; in September of the same year, 32 people worked in the start-up despite six people leaving the company during the summer (four of whom were sacked). That is a turnover of nearly 70 percent over the period—similar rotation rates are commonplace for a digital start-up. And this figure does not even take into account the innumerable trainees and other unpaid reinforcements who came to help out at some point or another in the life of the organisation. Thus, Elias points out to me that ‘in one and a half years, 48 people worked for PriceMatch [*there were 12 employee posts at this time*]. Today, we must be at around 60 or something like that [*that is, 22 employee posts, six months later*]. A lot of those people have worked for free or for the 436-euro internship compensation.’ A score of permanent members, including an inner circle composed of the founders and their close collaborators and friends, forms the backbone of the organisation. What motivates the participants varies according to their status. Most of the older members have invested a great deal of time and energy in order to ensure the success of the start-up. Thus, for them, PriceMatch is an essential act in which they express themselves personally and see further into the future.⁶⁶ Others come to work at PriceMatch to get an advanced taste of entrepreneurship (this is the case with several members who join the start-up with an entrepreneurial project in mind, which they will launch when they leave PriceMatch), or to be in touch with a certain atmosphere or start-up

⁶⁶ Sometimes with the explicit design of making their fortune, as with Adil, one of the cofounders for whom the question was settled from September 2014: “‘Be king or be rich?’ It’s a question that we ask ourselves as founders: “‘Would you rather have power, stay with the company and still be the boss in ten years’ time, or would you rather take a back seat and maybe leave at some point?’” Personally I’m completely with the latter. I don’t care about being the boss of a RMS company, that’s really not my big dream’; or in ‘search of recognition,’⁶⁶ like Alexandre who considers he has ‘something to prove as a person’ with the start-up: ‘I don’t think it’s that important for the newcomers, but for me, PriceMatch is a question of identity. Owning shares was extremely important for me because, beyond the money, the company is part of how I see myself. People don’t refer to me as Alexandre Devisme, they call me “Alexandre from PriceMatch.” And I like that because I feel that I’ve played my part in the company’s success.’ On the notion of recognition in sociology, see Alain Caillé (ed.), *La quête de reconnaissance. Nouveau phénomène social total*, Paris: La Découverte, collection « textes à l’appui », 2007.

culture (which can be defined in its formal opposition to the large firm), or to learn technical or business competencies.

Cédric: It seems a bit weird to say this but actually I did the internship because I had nothing to do with my holiday and no money. So I thought, rather than do fuck all at my house in the 78 [Yvelines department] and be bored shitless, I'd find an internship in Paris. That would force my parents to pay for an apartment there, and in return I'd be learning things, I'd meet people and get a bit of experience. So I chose a company that seemed interesting based on two criteria. Firstly, that there was interesting stuff to learn. Which is the case here because at PriceMatch maths is the added value, algorithms and all that. If you're working on the product, theoretically at least you'll be working on interesting stuff. Definitely more than if you're working in a company where all you do is enter a load of stats on past clients and send that to some supervisor or whatever. The second thing I was looking for was somewhere a bit cool. I was looking for somewhere to spend my holiday—it's a bit weird to say that, but that internship was the transition between the two years of my studies. So I didn't want massive pressure, to find myself getting whipped at Société Générale. A start-up seemed cool. So I ended up at PriceMatch. (Interview, 11 September 2014)

Cédric articulates here in passing one of the factors that differentiates the foot soldiers of the corporate world who find themselves executing pointless tasks in a large firm and those who exercise their skill in a start-up and participate in the digital economy: the same dispositions can lead to one or the other career depending on the structure of possibilities on offer, but also on the state of monetary resources, namely, the financial support provided by parents or other kin necessary to work in a sector where average wages are relatively low.

Organisations as Fields

Within the start-up, and yet in spite of the declared absence of hierarchy, it is possible to make the distinction between, among others, leaders and the led, producers and dealers, incumbents and temps. Correspondence analysis brings out a first opposition (the first factor represents 14.2 percent of the total inertia; see Appendix C) between the cofounders and those, followers from the outset, often friends and classmates of the cofounders, who hold or are on the point of getting

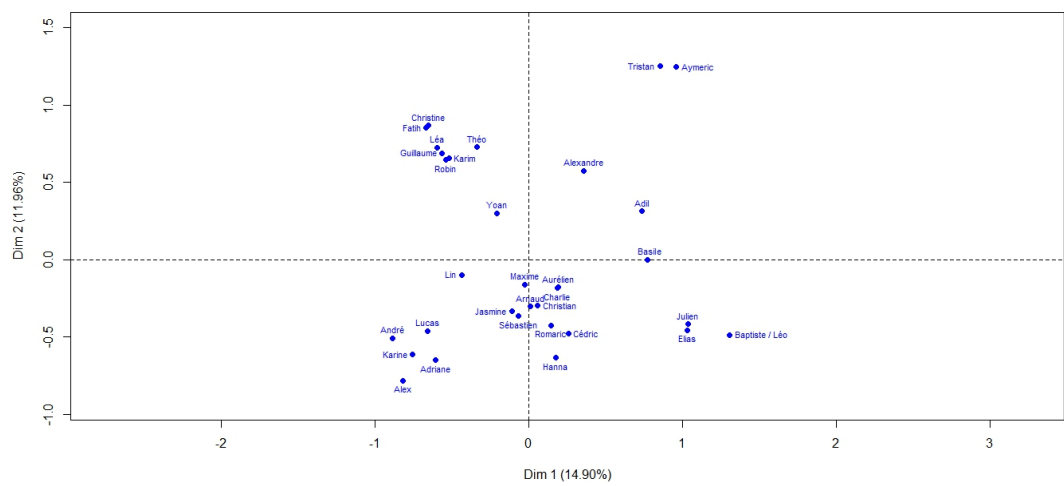
company stock and sit at the executive committee table, that is the management strictly speaking, who decide what strategic actions to take, and the rest of the team or workforce, who execute them.

On the one hand, the management team, essentially consisting of the cofounders and the so-called ‘Country Managers’. The strongest contributions to the first factor come from the former, in particular Baptiste and Léo, who held the highest positions in the company at the time—they were ‘CEO’ and ‘COO’ respectively—with 12.1 percent each; concerning the latter, Aymeric’s and Tristan’s contribution, whose job was to spread the good word about PriceMatch in Italy and in the United States respectively, was about 6.5 and 5.6 percent. Basile, who worked as ‘CPO’ for the company, may be added to this group of leaders, although his contribution is relatively weaker (3.8 percent).

On the other hand, the employees, who are spread among several teams / business units such as ‘Account Management’, ‘Sales’, ‘IT’, and ‘Development.’ Among the subordinates who make the strongest contribution to this first factor are employees, often members of the account management team, who are still serving their probationary period. This is the case with Christian and Samantha (4.9 and 4.7 percent) who have just arrived at PriceMatch, or students like Alex and Carine (7.1 and 5.7 percent) who have been here for a longer period of time and are completing an internship or work placement as part of their ongoing studies.

In the intermediate positions, we find, among others, the software developers and engineers who are in relative proximity to the decision-makers, although they often do not directly take part in any managerial activities. Often united by old school ties, the engineers directly work with the cofounders on a daily basis—we must not forget that three of the cofounders belong to the technical team.

Between these two poles are the members of the ‘development team’, including IT specialists, but also the ‘unclassifiabiles’ who are legion in such an organisation in which the chain of command has not yet been stabilised. These unclassifiabiles often directly report to Baptiste. This is the case with Ferial who is the head of the account management team, and therefore is not just an account manager; with Yoan who deals with all kinds of partnership issues; or with Hanna who does the accounting.



Graph I.2.1. Individuals, horizontal axis 1, vertical axis 2 (n = 34).

The first factor brings out a typical form of compensation in the new economy—namely employee stock option plans. This is a very popular method of attracting, motivating and retaining employees when the company is unable to pay high salaries, which is often the case for start-up companies. It is also how Julien explains the relevance of such remuneration schemes at PriceMatch: ‘Romaric desperately wants to stay. Romaric at his interview for the internship, he said: “How much do you pay on a permanent contract? How much do you give in stock?” We said to him: “Listen big boy, let’s just focus on the internship for now.” He took the bait straightaway’ (Interview, 18 September 2014). Those joining PriceMatch did not receive options and shares as soon as they arrived at the company. Instead, they had to wait a relatively long time to get them—it was generally the case that they were entitled to receive options after their first full-year of employment. It is noteworthy that there was no well-defined process of granting stock options to employees; rather, it was fairly negotiable. As a result, one could find at PriceMatch some individuals for whom shares came relatively quickly (e.g. Elias, who was given cofounder status right after a three-month internship in the company) and others, less fortunate, like Cédric who started working at PriceMatch in the summer of 2013 but, presumably because he came and went and worked part-time for some time, was never granted any options at all. In most cases, however, time mattered.

In fact, the length of service gives a fairly good sense of how the first factor can be interpreted as a model of the distribution of power and authority within the organisation. The reason is simple: being a shareholder gives some scope for influencing company activities—at the very least it facilitates knowledge of the company’s activities and access to its resources. As one example, a business unit manager, say one who supervises account management operations, who sits at the executive committee table and learns that the sales business unit will be strengthened by the recruitment of four new salespeople, can demand to be able to do the same and hire new members for her own team. Hence, appears the following opposition: on the one hand, the cofounders and their first recruits (e.g. Ferial, Alexandre, who embarked on the venture in the spring of 2013), who ended up benefiting from the employee option plan, who attended monthly executive committee meetings and took part in the company’s strategic decisions (pro rata of their stakes in the capital of PriceMatch); and, on the other hand, those who were

last to jump on the bandwagon and who did not have their say, like the new members of the account management team but also those of the sales team, which had been rebuilt from scratch over the summer of 2014.

However, neither the managers nor the members of the workforce form homogeneous groupings. There are objective divisions within them and, as we shall see, these find expression in their confrontations. The second factor (which represents 9.7 percent of the total inertia) shows up another opposition, which relates particularly to the company's commercial activities: on the one hand, the 'producers', who not only include the members of the technical team who produce, in the strict sense of the term, price recommendations, but also the account managers who provide advice and support in respect of revenue management to the users of the platform; on the other hand, the 'dealers', be they sales managers, salespeople, or merely telemarketers, who are in charge of selling the product and service developed and maintained by the 'producers'.⁶⁷

The second factor also highlights the spatialised nature of the organisation. We have seen that people of PriceMatch were spread across two offices in Paris—branches had also been opened in both Rome and San Francisco. In fact, the producers were all located in the main office, in Sentier; while the dealers were in Les Halles office, except for the two country managers. Following the theorists of 'world economies,'⁶⁸ one can see in such spatial division of labour a reflection of some form of hierarchical relationship between the core (i.e. Sentier) and the periphery (i.e. Les Halles and the offices abroad). This is only partly true. It is true to the extent that the salespeople and their managers were accountable to the management body, whose members were mostly located in Sentier. But when we

⁶⁷ This opposition between 'dealers' and 'producers' is reminiscent of the traditional distinction between circulation and production, which has been well-established in political economy since the English classics (Adam Smith, David Ricardo, John Stuart Mill), that is, the distinction between the relationships of people with one another and with nature.

⁶⁸ Immanuel Wallerstein, *The Modern World System: Capitalist Agriculture and the Origins of the European World Economy in the Sixteenth Century*, New York: Academic Press, 1974.

look a little closer, things were not so simple. To begin with, if we consider the first factor again, it appears that the account management team was even more subordinated to the management than the sales team was. It may be recalled that the account management team was the only team at PriceMatch which did not include in its ranks any cofounders. Secondly, wages and other compensation seem to give form, at least in part, to the second factor. It is clear that the distribution of wealth took place in such a way that the greater part went to the salespeople and engineers and the smaller part to the account managers. When we look at interns' remuneration, for example, we need to realise that telemarketers' wages were at least twice that of the trainee account manager, who earned the equivalent of 30 percent of the French minimum wage (a mere 436 euros a month in 2014). A telemarketer at PriceMatch received around 35 euros per appointment but for a task that was seen, even by those who held these jobs, as particularly unrewarding in all other respects.

In the top left-hand corner are the salespeople and telemarketers, who earn relatively high salaries, especially as they can receive a commission depending on their performance. A large portion of them are new team members. This is both because telemarketers, who are often interns, are usually hired for short periods of time, and because most of the salespeople, if not all, had only just arrived following the reorganisation of the team over summer 2014.

In the top right-hand corner, we find the managers of the employees just mentioned—let us recall that the sales team was jointly managed by Adil and Alexandre at the time. They had been on the job longer and, therefore, handled more decision-making responsibility. Tristan and Aymeric, the two country managers, make the strongest contribution to the second factor, with 14.5 and 10.6 percent respectively. They are also the most isolated members of the PriceMatch team.

In the bottom left-hand corner are the account managers. Although most of them have relevant experience in the hotel industry and in the domain of revenue management, the members of the account management team are paid relatively low wages in comparison to the rest of the team (Christian is an exception to that: as a senior account manager, he receives a salary comparable to that of engineers). One reason for this may be the large number of interns in the team.

In the bottom right-hand corner are the cofounders and other managers at PriceMatch—Baptiste and Léo are among the strongest contributors to the second factor, with 3.5 percent each. They are people with more seniority, higher responsibilities, and relatively humble wages given their high status in the company—at that time, the cofounders only allowed themselves a compensation equivalent to the minimum wage (1,129 euros in 2014). One can probably add to this group the engineers, especially those involved in backend and frontend development, in spite of their rather central, neutral position in the graph.

Considering illustrative variables now, we see that the cofounders, and to a lesser extent the middle managers and engineers, have been educated at the most prestigious secondary schools and the foremost *grandes écoles* (Ecole Polytechnique and Sciences Po), seeming to justify, despite their very young age,⁶⁹ their strategic position in the company. It comes as no surprise that the members of the management team are also members of well-off sections of society, with parents employed in learned professions, as physicians, chemists or artists (painter) or working as senior executives in state administration or business. One of the cofounders has parents who happen to both be *énarques*⁷⁰ and members of the high reaches of public service. In all such analyses, it is nevertheless important to avoid any type of crude generalisation. For example, Adil rose from a working class Paris suburban background—he grew up in La Courneuve, one of the most disadvantaged areas in France, which is incidentally where PriceMatch was registered—to enter Sciences Po based on his school record in 2007⁷¹ and cofound PriceMatch a few years later. The employees situated at the opposite pole come from a humbler

⁶⁹ PriceMatch is ruled by people who are significantly younger than most of the employees, making it the exact opposite of a gerontocracy.

⁷⁰ ENA graduates. The *Ecole nationale d'administration* (ENA) is probably the most elitist *grande école* in France, both because of its acceptance rates and because a large majority of its candidates have already graduated from the best French *grandes écoles*.

⁷¹ From 2002, The Institut d'études politiques de Paris, known as Science Po, started opening its doors to students from secondary schools located in disadvantaged areas on the basis of their school record and an interview, in order to diversify the overwhelmingly white intake.

background and generally lack the prized educational qualifications held by the managers—though nearly all of them have received a higher education. The youngest is 18 years old, the oldest 57, with the median age hovering around 25. Most members are men, and the management of the start-up is fundamentally a masculine space into which only Ferial has gained admittance under difficult circumstances where she had to face up to the disbelief—if not male chauvinism—of her male colleagues.⁷² Smaller in number, women are as well first in line to be sacrificed when the start-up encounters liquidity problems. When they realised that the cash flow was insufficient to pay the current instalments until the next round fundraising, the directors decided to bring the probation period of several members of the team to an end. All the people leaving were women. That is how between July and August 2014 Roxane first, then Ines, Augustine, and Adriane left the start-up. ‘It’s difficult for me to look at the situation and not see that it’s a sexist issue,’ explains Alex, account manager for the English-speaking customers. ‘In the time that I’ve been here [*Alex started in April 2014 along with Augustine, Ines and Adriane*], we’ve lost two men: we lost Franck who said “this really isn’t what I want to do”; we lost Guillaume who said “I’m going to the best school in the world.” They both left on more or less positive note whereas those three four are all leaving bitter. If we give them the benefit of the doubt and we say “no it just happens to be that they all had performance issues”, even still, they’re leaving bitter: Augustine is unhappy, Ines is unhappy, Adriane is unhappy, and Roxane is unhappy.’ In fact, inappropriate remarks to womankind and sexist jokes with sexual connotation are common currency in the start-up, and in the group of salespeople in particular. The low representation of women in the start-up universe is a fairly well-known

⁷² A particular episode illustrates these difficulties. In August 2014, the ‘seniors’ were to be rewarded for services rendered by being offered shares of the company. Basile, Ferial and Alexandre—because it is about them—had been recruited around spring 2014 at about the same time. In theory, they should therefore have received the same amount of shares. And yet, the founders had initially decided otherwise by granting 0.5 percent of the start-up capital to Ferial while Basile and Alexandre would receive 1 percent each. ‘I felt like a reward from the Islamic Republic,’ says Ferial, ‘the girl equals half the man.’ [*Interview, 22 August 2014*] After a long negotiation with the founding team, she finally won her case and received the same percentage as her male counterparts.

phenomenon which is regularly point out by the concerned parties themselves. In 2013, Pinterest technologist Tracy Chou highlighted the issue in her post (titled ‘Where are the numbers?’), which exposed the lack of published data from start-ups and mainstream tech companies on the number of women in technical roles.⁷³ Alex confides what he thinks would be the desirable proportions for each team of the start-up: ‘It would make sense to me that the account management and sales should be about half female, and the engineering team should be about 20 per cent female because less women go into those industries.’ PriceMatch still has a long way to go, as it counts no women in the technical team at all.

In the top right-hand corner, are the sales team managers who are well endowed with degrees awarded by some of the best *grandes écoles* in the country (Sciences Po and other business schools such as ESSEC and EM Lyon) and have fairly high social origins, for example a physician father and a chemist mother, which explains in part such academic success. Adil and Aymeric are exceptions, as both come from a working-class background (Aymeric’s parents are bakers) and both have received good higher education.

In the bottom right-hand corner are four of the cofounders. They are young, *polytechniciens* (except for Baptiste who only holds a Master’s degree at the Ecole Polytechnique and is not entitled to this status as he did not go through the selective entrance examination at the beginning of the *polytechnicien* cycle), and come from higher social origins (e.g. one has a father who is CEO of a major public corporation in France and a mother who is General Inspector of Social Affairs).

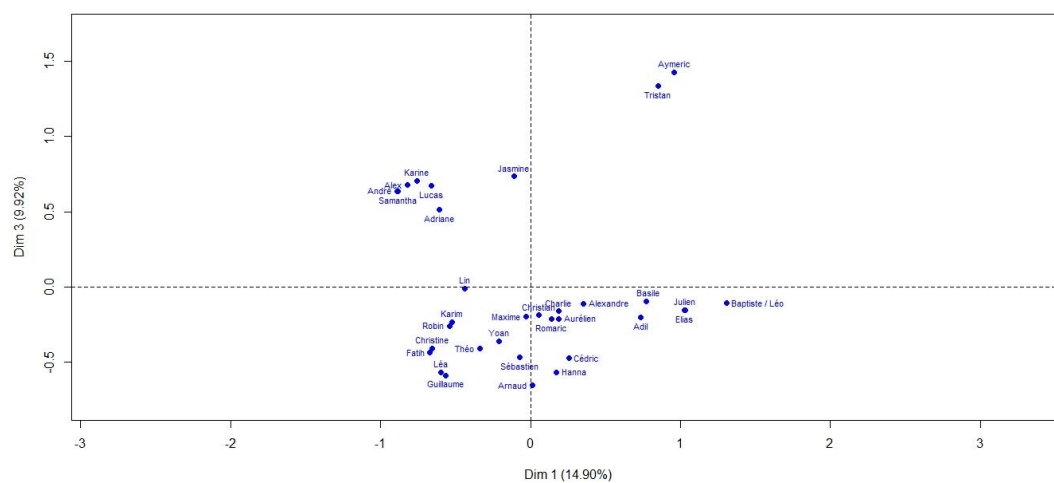
In the bottom left-hand corner, we find the account management team, whose members often hold degrees in tourism and hospitality. Several of them have a specialty in revenue management and went to some of the few academic institutions in France which offer courses on the subject such as ESSCA-Angers University and SKEMA Business School-Ecole Ferrières; Alex received the ‘Certificate in Hotel Revenue Management’ from Cornell University. This team

⁷³ Tracy Chou, ‘Where are the numbers?’ Medium, 11 October 2013 [online]. <https://medium.com/@triketora/where-are-the-numbers-cb997a57252> [consulted on 20 February 2018]

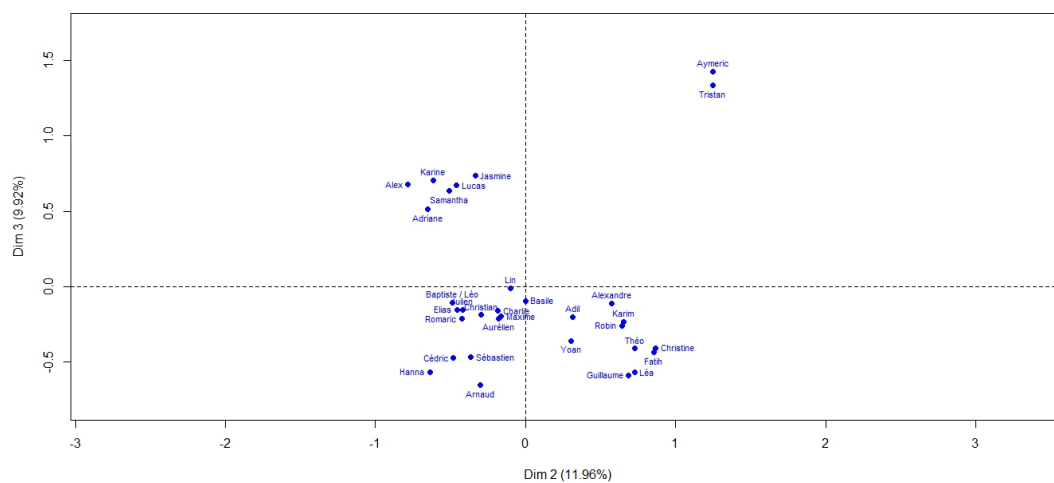
has the largest proportion of female members with 57 percent (excluding admin). It has also the highest average age, around 31 years old.

In the lower part of the graph, the members of the technical team (all male) are situated in an intermediate position. With regard to social origins and education, there is a clear separation between the engineers and IT specialists. While the former share with the cofounders, whom they often met at school, a high socioeconomic (e.g. fathers who are an engineer or physician) and educational status (they all went to major engineering schools such as Ecole Polytechnique, Télécom ParisTech, Arts et Métiers ParisTech), the latter, from much lower social classes (fathers who are a mechanic or low-grade civil servant), have only received short vocational training. (It is important to note that this relationship is in no way systematic; see, for example, the case of Maxime, an engineer at PriceMatch, whose father is a farmer.)

Finally, in the top left-hand corner are the salespeople who come from heterogeneous social origins ranging from a farmer's child to the daughter of Parisian bourgeois parents with prestigious graduate studies. A quarter of the sales team are women. Among them is the doyen of PriceMatch—age: 58 years old.



Graph I.2.3. Individuals, horizontal axis 1, vertical axis 3 (n = 34).



Graph I.2.4. Individuals, horizontal axis 2, vertical axis 3 (n = 34).

As for axis 3, this isolates a small group of ‘independents’. Contrary to most of their colleagues at PriceMatch, they did not make a strong commitment to the start-up. Instead, they often worked part-time or no more than the legal 35 hours per week and were able to preserve multiple affiliations, in particular their academic ones. Among these independents, two types of profile can be recognised. On the one hand are self-employed engineers who mainly came to learn something at PriceMatch and to make a little money while they were about it. They often still had a foot in academia, eventually wanting to pursue further studies, for example in the fields of mathematics and machine learning. On the other hand are those with apprenticeship contracts who often divided their time between PriceMatch and their professional training centres. This type also share a certain number of social properties (they come from a working class background: for example, one’s father is a mechanic) that distinguish them from the independents of the first type (who are often sons of senior private sector managers).

On the one side we find the apprentices, Hanna and Arnaud, who appear to be the strongest contributors to the third factor, with 17.9 and 12.9 percent respectively. Hanna does the accounting and invoicing at PriceMatch. She only works part-time as she is completing a two-year vocational training in accounting (*brevet de technician supérieur* or BTS) at the same time. Arnaud is also on a sandwich course but in computer science and only comes to PriceMatch three days every week, where he works in the IT team. Other contributors are self-employed people like Cédric and Sébastien, with 5.4 and 3.6 percent. Cédric is a student of Arts et Métiers ParisTech and an engineer and data analyst in the Algorithm team (although he works from time to time with the backend people). Over about a year, he has completed a series of internships and short-term assignments for the company, but has never really laid down his hat in the start-up. Sébastien, a Polytechnique graduate, also works on the algorithms as an independent contractor but, contrary to Cédric who often does the minimum, Sébastien does not count his hours (around 43 hours weekly) and, in fact, spends most of his time at the office.

At the opposite pole come people of PriceMatch with other types of employment contracts, though they do not necessarily benefit from a more secure employment status (e.g. interns). We find, again, the country managers, Aymeric and Tristan, who contribute 6.7 and 6.5 percent respectively to the third axe. They both state that they work 60 hours per week.

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We have seen how the ecology of the corporate world and the culture of the large firms predispose the young people of PriceMatch to conceive their work as a meaningful activity which provides them with a space to perform the values which they hold dear, of innovation and entrepreneurial spirit. From this perspective, the large firm and the start-up are found in a relationship of rejection and opposition. However, once the temporal dimension is taken into account, this relation is ruptured and reversed by the financial imperative that ‘startupers’ must obey, which seizes on the start-up capacities to the pursuit of different, more directly functional and distant goals. Thus the first thing that founders always stress is the objective of development and rapid growth of the company. Baptiste sketch out the perspective of the start-up he runs: ‘Today we are thirty employees in the company. With the next round of fundraising, we go to a hundred or so—rather eighty—and that in the space of three to four months only. So we have to hire fifty people in a few months, across eight offices around the world’ (Interview, 21 August 2014). In other words, it is necessary to spend lavishly in order to grow as quickly as possible

In the start-up universe, ‘survival’ is not synonymous with ‘success,’ as in the neoinstitutionalism scholarship for example⁷⁴; quite the contrary, although there are several admitted ways to succeed, the outcome is always the same, that is, the loss of the social life and identity of the start-up.⁷⁵ All in all, as will become apparent hereafter when I examine the mechanisms and politics of value-creation, the start-up can be seen as a liminal and transitional object which is attracted to its exact opposite as by a magnet and whose disappearance is thus ineluctable—through its

⁷⁴ See, for example, John W. Meyer and Brian Rowan, ‘Institutionalized Organizations: Formal Structure as Myth and Ceremony,’ *American Journal of Sociology*, 83 (2), 1977, p. 340-63; Paul J. DiMaggio and Walter W. Powell, ‘The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields,’ *American Sociological Review*, 48 (2), 1983, p. 147-60.

⁷⁵ It is noteworthy that ‘success’ here is closer to the Spanish terminology which translates this term by ‘éxito’.

purchase by a larger company or an initial public offering, or IPO, or simply by the defection of investors. So much that the start-up members dream up their professional future, as the manager of such and such service, in a form of organisation that has very little to do with the start-up here and now.

Karen: At the start of 2014, I worked at Quick for a few weeks to keep afloat, and that was the moment when I said ‘OK, I think I’m just going to have to forget about consultancy’. So I did a few months temping in an insurance company—they were putting in place a new IT system so they needed someone to enter information into their database. Then, from September to December, I was just looking for any kind of work. And one day, on APEC [Association for Executive Employment], I found an advert for Pricematch who were looking for an administrative assistant, basically a secretary. I wasn’t exactly over the moon. I mean, shit, five years of studying to end up as a secretary, what a joke. I turned up without having done any preparation. In the end the three people I met—Alban, Adil and Léo—convinced me with what they came out with, with what they were doing, with the atmosphere. So I thought ‘OK, I’ll try it. It’s not like I’ve got any other offers’. And that’s how I ended up at PriceMatch. Not because the job was particularly interesting—they sold me the thing on the premise that with it being a start-up, one day the company would be getting bigger, and my post might develop... So I said to myself that if I can prove myself in this bullshit job [*‘boulot de merde’*] to begin with, perhaps I’ll have the chance to do more interesting stuff.

Vassily: They said that explicitly to you?

Karen: When I met Alban, I told him ‘It’s a while now that I’ve been job searching and I haven’t found anything in consultancy. So now I’d rather start from lower down and climb up’. And he said to me ‘yeah, there’ll be opportunities to develop within the company. (Interview, 29 May 2015)

Alex: My career objective, or my career sort of idea, is that I would like to stay with PriceMatch. And I can see the company doubling in size. It’s almost doubled in size since I’ve been here; I can see it doubling again in the next six months to a year, and then doubling again. In two years, I can see all the work that I’ve done bearing significant amount of fruit, at which point I won’t be a revenue manager anymore. So that would be cool.

Vassily: What do you see yourself doing?

Alex: I don't know, I could be a manager? Like Basile for example, he started as a revenue manager and now he's the chief people officer. He started much earlier than I did, sure. So maybe it would take more than two years but that is the kind of thing that I'd like to do. (Interview, 21 August 2014)

At the sale of the start-up, in May 2015, Karen will be given a position having nothing to do with her qualifications in the human resources department of Booking.com, which she will decline. Alex will be dismissed.

The start-up thus defines itself against large firms, in much the same way as Marcel Mauss has argued for the Arctic societies, in and through a process of schismogenesis⁷⁶: at the same time that it interacts with them in the normal course of business and has no prospects except becoming just like them or being assimilated by them, the start-up stands opposed to the large firms as motion is to inertia, as the release of individual and collective initiatives is to the constraint and routine hindering them, as the efficient—at least from the standpoint of development and technological innovation—and labile organisation of a creative and didactic work is to the hierarchical and functional organisation of a strictly normalised and clearly divided activity symbolised by the bureaucracy of private and public administrations in which most startups have spent some time.

Baptiste: 'I Like Telling Stories'

Baptiste was born in 1990 in France, his father a private sector manager and his mother a teacher. Right from *lycée*, Baptiste wanted to be an entrepreneur, as he

⁷⁶ Marcel Mauss, *Techniques, Technologies, and Civilizations*, Nathan Schlanger (ed.), London: Berghahn Books, 2006 [1913/1948]. The notion of schismogenesis has been coined by Gregory Bateson, which he has defined as 'a process of differentiation in the norms of individual behaviour resulting from cumulative interaction between individuals.' Gregory Bateson, *Naven: A Survey of the Problems Suggested by a Composite Picture of the Culture of a New Guinea Tribe Drawn from Three Points of View*, Cambridge: Cambridge University Press, 1936. For application of this principle in recent work, see James C. Scott, *The Art of Not Being Governed: An Anarchist History of Upland Southeast Asia*, New Haven, CT: Yale University Press, 2009; David Graeber, 'Culture as Creative Refusal,' *Cambridge Anthropology*, 31 (2), 2013, p. 1-19.

explains in an interview on 21st August 2014: ‘My sister and I used to think up ideas for companies. It’s something I’ve always been interested in. But no-one in my family has set up a company. Perhaps in my extended family but it’s not something I’ve grown up with’. In 2011, Baptiste was playing with the idea of creating his own business with Adil, a classmate that he met in the lecture halls of Sciences Po Paris (‘He wanted to do something in Islamic finance, but it never happened’), but it was only a year later that the idea became a reality, with the creation of PriceMatch S.A.S. in January 2012. Baptiste was aged 22.

One of the investors, a rich 40-something manager of his family’s hotel business which includes 15 or so hotels in France, and who sits on the board of the start-up, harbours a certain admiration for Baptiste. On 31 March 2016, several months after Booking.com had bought the start-up, he gave me his analysis of PriceMatch’s success: ‘What made the company, it wasn’t me; it was Baptiste’s personality. His partners of course too, but particularly Baptiste. He knew how to connect people, get people talking about his product, create enthusiasm around it.’ ... ‘I think that guy has a capacity to seduce, to sell, to convince, and that also played a role with Booking. You know, the personality of the boss, that’s what the success of a company depends on.’

Between 2004 and 2007, Baptiste attended the international *lycée* at Saint-Germain-en-Laye, where he met two of his future associates, Léo and Julien. In 2007, he was selected to attend the Institut d’études politiques (IEP) in Paris, and followed a program in ‘Sciences and social sciences’, notably directed by Bruno Latour, and organised jointly by Sciences Po Paris and the University Pierre et Marie Curie (UPMC). His choice was strategic: ‘I was a bit lucky because you had to have heard about it. I was only the second year they did it, so I imagine that the ratio between the number of applicants and the number actually accepted wasn’t too bad... I wasn’t a big fan of maths but I’d done a Bac S [*the scientific stream of the Baccalauréat*], and most importantly it meant that I didn’t have to sit the entrance exam.’ At Sciences Po, Baptiste met two future cofounders of PriceMatch, Adil and Timothée.

These three grew closer in 2009 in New York during their year abroad. Having achieved a double-degree in mathematics and science and technology studies, Baptiste turned towards finance, and, between 2009 and 2010, attended lessons at New York University Leonard N. Stern School of Business. On his return to France in 2010, he took a prestigious master’s in Economy and Public Policy, organised

jointly by the IEP in Paris, Ecole Polytechnique and Ecole nationale de la statistique et de l'administration économique (ENSAE), but he didn't finish it. 'There aren't many lessons, but you really have to work in your own time. Back then, with PriceMatch going on at the same time, it wasn't easy. I got taken apart by the teachers, and I had to give up after three months.' In 2014, he ended up with a master's in Finance and Strategy from Sciences Po Paris.

Whilst studying, Baptiste did several internships, particularly in the finance sector: at the International Monetary Fund (IMF) in Libreville between March and June 2011, and from June 2011, at Goldman Sachs in London, where he took care of banking supervision and portfolio strategy. It was during this internship in the big investment bank, whilst his career seemed to be taking off, that the *need* to start his own business was strongest and things started to speed up: 'The real trigger is that I was just having a really bad time at Goldman Sach, and so I told myself I really needed to find a way to get out of this.'

In 2009, during a seminar on economics and sport that he was taking at *Stern*, Baptiste learnt about a start-up specialised in dynamic pricing for sports events, Qcue. At this time, the company was attracting attention from commentators for its success in landing huge contracts with several big clubs from the American National Baseball League. Baptiste was convinced that a market for dynamic pricing existed in France, and more generally in Europe, in the football industry. In September 2011, Baptiste decided to suggest this idea to three of his friends and old classmates, Léo, Adil and Timothée. With the others keen to get on board, the small team got to work and put together a dossier that was presented to the incubator at Sciences Po in November or December 2011. 'It's a ten-slide PowerPoint presentation. You arrive in front of a jury of ten people who've never heard of your idea and you have ten minutes to convince them. A lot of it is down to luck, but they tell you that it's no different in your life as an entrepreneur.' Their project was accepted. In January 2012, Baptiste quit his internship at Goldman Sachs and returned to Paris.

Baptiste has worked in practically every role at PriceMatch. At the start of 2012, he worked with Léo on the design for the prototype for the algorithm ('I took care of the econometrics, because Léo had never done that'). It was he who designed the first user interface in Excel ('I pretty much designed the product: I'm the one who did the Excel'). From summer 2012, Baptiste worked on the commercial side with Adil and the first interns, during the launch of a huge door-to-door campaign

on the streets of Paris ('We hired interns from the EBS [European Business School of Paris] and went out with them to work on sales'). He also worked on creating partnerships with suppliers of property management systems and channel managers, before progressively delegating this task to Yoan in 2014 ('All the first partnerships, that was me; I was the one who went to see them, who canvassed them'). In much the same way, having been in charge of the team of account managers ('when we started having some clients, I became director of account management'), he passed this role on to Ferial in June 2014. As he puts it: 'As soon as I can delegate, I delegate'. That said, it is still Baptiste who, even in summer 2014, calculated the regression coefficients used to predict long-term demand.

When I meet him in May 2014, Baptiste is the president of PriceMatch, a position that, according to him, simply consists of 'representation'. Representation, here understood as external representation, is that which is said to stakeholders outside of the start-up. Baptiste is very much capable of talking in public ('I like speaking at conferences'). He makes full use of this talent to convince clients and partners, in particular the 'big ones' ('Nowadays what I like doing most is the big projects: the big chains such as Accor, the big PMS, the big channel managers'), and to negotiate with investors:

'I am very much involved in raising funds. I am the one who talks to the investors all the time. For me, this is external representation. I think that, among the partners, I'm the one who can best tell stories. I like telling stories. And when you raise funds or when you give a presentation at Best Western, what they like is that you tell them stories. And I like that. My partners, most of them, don't like that. So I think that this is my strongest added-value [to the group]. Those guys, you don't convince them with numbers, contrary to what people may think. Even investors. Our business plan, they didn't even look at it. We had to do one just for form's sake, but no one looked at it. Really, all they listen to is your story.' (Interview, 21 August 2014)

Léo: 'Revenue Management Is Like Physics'

A *polytechnicien*, Léo is part of the founding team of the start-up. He is 24 and has known Baptiste since high-school—they were in the same class in their final two years. With a strong background in science and technology, Léo first took care of the creation of the price recommendation algorithm; he was also the person

responsible for creating the first interface connections with the PMS, or 'RFC'. As time passed, he went from a strictly operational role to a strategic role that led him to define the priorities and direction of the technical team. Today, he is also responsible for financial issues, notably fundraising, but 'not the representation side, that's Baptiste', he assures me. Very close (they share a house in the upper reaches of Ménilmontant in Paris, where they throw a few parties with employees from PriceMatch), Léo and Baptiste occupy perfectly complimentary positions in the start-up. At the risk of caricaturing too much, Léo creates the product and Baptiste sells it; a sort of parallel act to Steve Jobs and Steve Wozniak at Apple.

In 2009, after doing the *classe préparatoire* at lycée Sainte-Geneviève in Versailles, Léo was accepted at Polytechnique, at the same time as two future cofounders of PriceMatch, Julien, also a classmate from high school, and Elias. In the third year, he enrolled in the Master's in Management and Innovation 'for the business side of it'. In the fourth year, he chose a Master's that was 'not very demanding' in Network Engineering 'to have enough time to do PriceMatch'. 'A complete education', is his summary, with a 'strong strain of maths, applied maths and physics' as well as a solid base in 'economy, statistics, a bit of econometrics and a bit of IT too'. In 2011, Léo did an internship in an arm of GDF⁷⁷ Suez in Moscow; then, in 2012, also in Moscow, at Orange, when PriceMatch had been already registered. 'I did a few internships' ... 'that basically taught me that you don't learn much in a big firm' ... 'and which encouraged me in the idea that I wanted to create my own company.' Léo comes from a well-off family on the edges of the aristocracy: his mother and father are both *énarques*, one director of a large public company, the other working high-up in the civil service, they own a few properties on the Ile de la Cité in Paris, etc. For him, create his own business, 'create an idea from scratch without owing anything to anyone', was a way of 'earning respect' from his peers, even if he does admit that 'given my studies, my socio-economic background, I'm pretty privileged compared to other people'.

When Baptiste came to see him with the idea for PriceMatch, Léo was immediately on board: 'Straight-away I thought the idea was very good. What was particularly interesting was that it attacks' ... 'a major market dysfunction, which is that the information available on the reserve price of the customer and the real sales price of the business is asymmetrical. And so you can say to yourself' ... 'that the

⁷⁷ *Gaz de France*.

functioning is less than optimal by a few percentage points. That means that if you could solve that problem, offer to every consumer his or her reserve price, and if you did that for every good in the world, you could increase global GDP by 5 percent.’ ‘Market dysfunction’, ‘asymmetrical’ information, ‘reserve price’, this is specific vocabulary from microeconomics that Léo seems to master perfectly. However, when we get onto the discussion of the problem of revenue management, it’s not economics that he spontaneously refers to, but physics: ‘I find the issue interesting.’ ... ‘It’s that the problem of revenue management, it’s a problem of modelling. It’s like physics—it’s even like law actually: you’ve got a reality; you try to cut it into hypotheses to generate a model; then, you do some testing to get the data; and then at the end, you manage to model reality. And so in that respect, it’s a quasi-scientific discipline. I mean, it’s true that there are still lots of sources for improvement: in terms of the amount of data that you take into account, the behaviour of consumers, the way you collect data on consumers, etc. That can change a lot of things. Because what’s interesting is also to see the start-up side and the R&D side in a start-up, which is under so many financial constraints, etc., that it doesn’t always take the route that you would want as a scientist. So if we’d wanted to make an incredible revenue management model, we’d have had to spend lots, lots more time. But we have to pay social security... (Interview, 24 September 2014)

3. A Politically ‘Scientific Pricing’

The work of price-setters in the hotel industry is an analytical and rational activity that aims to increase, by adjusting the price and availability of rooms, and with the help of sophisticated algorithms, the profitability of a particular hotel. These algorithms do not eliminate ‘the need for human judgment entirely.’ ... ‘There will always be variables that cannot be accounted for in such algorithms.’ ... ‘The objective in developing optimization models’ ... ‘is to allow yield management agents to focus their efforts on these variables by making routine tasks more systematic.’⁷⁸ Thus, there is between the man and the machine a specific division of labour, which raises the ‘agent’ to the rank of skilled workers, at ease with statistical undertakings and with a good knowledge of the hotel sector. Nevertheless, what is striking at PriceMatch is less the analytical character of the work of price-setters, or account managers as they also are called, than the importance of control activities.

Indeed, account managers spend only a small fraction of their total time of work on statistical analysis and other studies of the kind. Much of their work consists not of production but of monitoring.⁷⁹ Many candidates, trained in revenue management in business schools, turn out to be disappointed by the lack of any analytical dimension in their work and resign from the start-up after a few weeks, to the great displeasure of Ferial, the head of this unit, who tries to attract these very professional profiles: ‘I’ll tell you about our role according to the job description.’ ... ‘Normally an account manager should spend 60 percent of their time checking

⁷⁸ Peter P. Belobaba, ‘Airline Yield Management: An Overview of Seat Inventory Control,’ *Transportation Science*, 21, 1987, p. 63-73, p. 67 (quote).

⁷⁹ Much like in our societies, men occupy in general activities of production while women are restricted to those of reproduction, the team of engineers who contribute to the construction of the algorithm at PriceMatch is exclusively made up of men, while that of account managers who control and make sure of the quality of the prices produced by this algorithm is predominantly female (4 women and 3 men)—see Chapter 2.

platforms: make sure that everything is fine, send emails to push certain dates, etc. Because unfortunately, you always have clients who don't connect, so if you send them a little email saying "on this date you're already 80 percent occupied, you should push your price up," that gives them a reason to connect, to get interested in the platform. Normally, each account manager should visit a client once per week (although not the same client mind). But I have the impression that people are a little sedentary here and that rule hasn't been too successful... So that, that would be around 70 percent of our work. And 30 percent of our work, that would be to make suggestions of ways to improve the platform, all the necessary improvements on the platform, we talk about them. I think that we do that well—Léo said that to me that we do that well and I hope he was being honest. That's the thing that we AMs are most interested in. It's much more interesting to develop a product, to say "it's missing this, it would be good to add that," than to check all the platforms. No disagreement there. So that's how I see the post.' ... 'But in reality, the account managers spend 50 percent of their time sorting out bugs: bugs on the PMS interface, bugs in the algorithm, bugs bugs bugs.' (Interview, 22 August 2014)

Although they can in principle manage their time as they like (as is the rule in the start-up), the members of the account management team have in fact a fairly well-established work routine, based on the pace of hoteliers whom account managers are in regular and frequent contact with. The typical menu of a day consists of more or less the same elements for each account manager. In order: answering emails, checking the imports of availability, analysing the activity reports, checking the price recommendations on the platforms and, if time permits, working on particular studies (competition, budget, etc.). The time spent on each of these tasks fluctuates according to the portfolio of hotels and from one account manager to the other. The following description applies to most of the account managers in charge of Europe-based customers. As an example, here is Carine's typical day. She gets to the start-up just before 9:30am, puts a Tupperware in the fridge, and sits down at her workstation. After turning her desktop computer on and chatting with Feriel and colleagues of the team, it is time to get to work. She begins by opening her inbox *pricematch.travel*, checking the emails that require a quick response, replying by email or by phone. Then she logs into the platform and, browsing the calendars of the hotels in her portfolio, she makes sure that the

occupancy rates have been uploaded properly from the properties' PMS—and, otherwise, she contacts the hotelier to arrange, as soon as possible, an intervention of the technical team, to fix the broken script on the reception's computer. She consults her mailbox again, this time to examine, for all the hotels that she is in charge of, the 'activity reports' on the largest fluctuations in the prices of the client-property and competition and in the occupancy rate—all values being measured in comparison to those of the day before. Just enough time to check the price recommendations for critical dates (and even, from time to time, to modify them when considered 'wrong') and to reply to non-stop calls from clients, it is already lunch time: she has it at the table situated in the centre of the room, in the company of the members of the account management unit. Carine closes her day around 6pm, at an early hour in the start-up, one could even say at 'office hours', replying to the last phone calls of the day and to the new emails which have arrived as well as those of less importance that pile up endlessly.

On this basic pattern, which varies little, are added other activities, like more in-depth control of the platform, indicators (occupancy rate, price suggestions, price of competitors, customer segmentation, etc.) and their variations: once every three weeks, Carine conscientiously reviews all the hotels of her portfolio. Besides, fortnightly, she attends the team meetings, in which she relays the possible requests of customers and the bugs that they have experienced in order to improve some features of the platform—these discussions on the technical aspects of the product, to which Léo participates as the Director of Operations, makes the connection between the users and account management work, on the one hand, and the algorithm, on the other. Client service activities are supplemented by 'side projects': Carine works in collaboration with Romaric and Sébastien on the prototype of a hotel pricing system for Lucien B., or Freddy, a former Director of Revenue Management at Accor, who now starts up his consultancy firm; she also carries out market studies for client-hotel.

The Factory of Prices

Carine: In the morning, when I arrive, I open my emails, I deal with the urgent stuff. When you see an email from a client that's not happy, you deal with it straight away.

Vassily: Do you get a lot of ‘not happy’ clients?

Carine: It’s not so much that they’re ‘not happy’, it’s more *clients who find that the product hasn’t quite performed right...* It’s stupid but, if a price transfer doesn’t work properly, the client will say ‘once again PriceMatch does not give me the right price, I can’t do my yield [management]’. All it takes is a client who decides to do their yield [management] at 8am and you arrive 9 or 9:30, and you end up with an email saying: ‘I’m not happy, I haven’t received my prices’. Or a PMS breaks. That’s the second thing I do in the morning, look up which hotels haven’t had their price imports and intervene as quickly as possible, or at least warn the client: ‘we haven’t had the import today, so your ORs [*occupation rate*] aren’t necessarily right, don’t follow our recommendations, we need to work on them.’ After that I look at the activity reports. These are the reports ... that show the biggest variations in ORs for a hotel between today and the day before, and the biggest variations for its competitors. I look at the reports for all of my clients, note the important dates for each client and look at the platform for those dates. Normally, if a client takes fifteen rooms out of thirty, I would hope that the recommendation will increase. *I check that it is coherent with the pick-up and I look at the important dates to see if the algorithm’s rec [recommendation] is right. If it isn’t, I make sure I change it in advance, before the client notices it.* It does happen that there are mistakes. Actually it happened last week: a client who had an 83 percent OR, and took ten rooms, and the algorithm told him to lower prices...

Vassily: You mean that your job is also to bail out the machine when it messes up?

Carine: Oh yeah! *Check the prices are coherent, logical, that they make sense. And if they don’t make sense, I do everything that I can to change the recs, playing with all the different settings that we have. But when it’s just one date that looks wrong, I just change it by hand and put a recommendation that I think is right.*

Vassily: And the platform allows you to do that.

Carine: Yes very much so. But Lucas and I are the only ones to do it. The others just wait for it to sort itself out on the whole. We all have distinct roles in the BU, and I’ve been given authorisation to do that. At the start, Feriel checked all my recs but now I’ve just been told ‘it’s fine, change them how you think’s best’.

Vassily: The other way to do it would be to change the weighting, right?

Carine: Right, *change the weighting of competitors, change the objective (either by lowering the OR or lowering the average price), events, etc. That's where you can play around with it.* Then redo the import, launch the algorithm again, because it may be that it hasn't launched itself, or it may be that the hotelier's just changed the price and you haven't taken it into account... The thing with the algorithm, one of its weaknesses is that it's a bit slow to take into account changes made by the hotelier. For example, in Spain, when they lower their price by thirty euros from one day to the next, the drop will be registered straight away because we take into account the average price for the last few days... so that can create recs that are way out. So *sometimes I just them change by hand. I try to do it as little as possible but I prefer to just do that quickly before the client notices. As soon as the client calls to say that the rec is wrong, you've lost your credibility, they trust you less.* Then you do have clients that are totally cool with us, they trust the recs, they just check quickly in the morning and send the prices, they don't ask any questions. And there are some that ask questions every day, 'why this rec?', then they'll look for the date right at the end of the month and be like 'why does it say that?'.

Vassily: They're things that you don't think are useful to look at in detail?

Carine: What I do, I look at my hotels in real detail three times per week. That takes up most of my day. I look at the platform, I download the Excel thing, I look at each day, look at the variations. The thing is, I'd like to do that more, but when you've got a client calling you, interrupting you, you have to respond and so sometimes I don't have time to check the platforms. But I try to do it properly three times each week. And the activity reports and important dates I do every day. I make sure I do that everyday, each morning, *just to see the big mistakes, the big surges in activity that we need to keep an eye on.*

Vassily: Is that it for a typical day?

Carine: Generally there are also meetings, meetings to improve the algorithm. That's our second objective as an AM, as RMs: improve the algorithm, give feedback on what clients ask for, about bugs. Sometimes I have external meetings. Not very often, because I don't have many clients in Paris. I also have other tasks. This is a new thing, we're starting to have side projects now. At the moment, I'm working on the thing with Freddy Bodin from Accor. Then I've got a new task for a hotel that wants us to look at their budget and their strategy for 2015. Generally

that means doing a study of competitors, a report on the figures. I have little tasks like that. (Interview, 4 August 2014)

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Lucas: *You need to check all the time that that's right, that you have the right fares, that the recommendations are relevant, etc.*

Vassily: And so how do you work? What is a typical day for you?

Lucas: At the beginning of the week, generally, I try to check the payments of all my hotels. Then I look at, for example, all that is concerned with broken PMSs or clients who do not log in. And generally depending on my checks on the platforms, I have stuff to discuss with the clients. Next I send emails or I call them to talk about fares, things I don't understand, why is it too expensive or too cheap, etc. Well we discuss.

Vassily: The relationship with the hotelier, is it important for you?

Lucas: It all depends on hoteliers. Some are autonomous. I myself have clients who only call me when there's something wrong. And, with those people, we talk about everything but recommendations, because they know [their revenue management]. You can't simply tell them to follow a recommendation, and especially if you don't yourself find it necessarily relevant for her hotel. They like the platform, they pay, I check again just so that everything works and that's it.

Vassily: And when they don't pay yet?

Lucas: Then you have to try and find a way to convince them [the hotelier], or make sure that the recommendations are getting it right. Everything depends on how the hotelier approaches the thing. *Some of them treat it like some magical power.* They follow everything and don't ask questions. Then there are others for whom it is a decision-making aide. So they just look at the dates etc. And then there are others who just sit on the fence with the thing. Like, when they have a rec that they like, they go for it, whatever. For me, they're the best ones. They just look themselves, don't ask any questions about the recommendations. They don't bother you. ... I don't reckon that you have to upload all the fares, all the time, that you have to blindly follow the recommendations. *The recommendations are based on a mathematical logic, but it isn't necessarily one that always works.* For example, if there's no pickups, we will ask to drop [the price]. But if, for example, on this specific date, you have an event and that the client knows perfectly well that she's

going to take [bookings] at the last minute, then she may be right not to lower her fares, perhaps lowering her fares too early is a mistake. That, that is a general criticism that we can make to the recommendations, that these are a little too pessimistic. ...

Vassily: So you check the recommendations on the platform, and then what do you do?

Lucas: *I change them so that it is as I feel like it. In all the setup that we make, generally, we want to make sure that we like the platform. And then I ask the client if she likes it. And, depending on the feedback she gives, we make changes so that it's more coherent with her pricing policy.*

Vassily: And you, do you sometimes change the recommendations directly on the calendar?

Lucas: No, because I reckon that I won't be always looking at it; that I prefer that the setup is good, even if I have a rubbish date. I prefer that on the whole it is coherent; that it is a logic that the client understands, rather than changing a recommendation, because this recommendation will then be fixed, and so if there's a huge pickup or that the competition['s price] soars up, then I won't be able to react.

Vassily: But you take the risk of having a negative comment from the hotelier, or even of losing her?

Lucas: I don't think that she'll piss you off for one date; it's more the overall consistency over the 90 days that she'll judge than one or two dates really rubbish. If you do your setup correctly, you're not supposed to have really rubbish dates. Well normally. ... So yeah, I check the platforms to see if everything is alright. And then, in general, I send emails to give advice or I call the clients, either because they haven't logged in or because there's something interesting to tell them, in particular for those clients in their trial period whom you always have more to say to than clients who already pay. (Interview, 5 August 2014)

There is a fascinating parallelism here between the account managers of the start-up and specialised workers of the factories of industrial capitalism—a world which could not be more remote a priori from that of the so-called 'new economy.' Account management resembles in manifold aspects a repetitive, if skilled,

industrial work: on the one hand, controlling the ‘quality of prices’⁸⁰ displayed on the platform, just as one would check the aspect of a manufactured piece coming out of an assembly line; on the other hand, fine-tuning the machine that account managers know almost intimately—sometimes even better than engineers—and of which they appreciate the sensitivity, according to many parameters (competition weight, objective of revenue or occupancy, events weight, etc.). Moreover, this parallel with industry and the process of industrialisation is in a sense recognised—even claimed—as the following extract from the company’s blog indicate: ‘We have therefore decided to *industrialise and democratise yield management* for all hotels. How? By conceiving algorithms that predict future demand and give to our clients price recommendations to help them maximise their revenue.’ ... ‘PriceMatch wants to *start the second yield management revolution by industrialising it more* and making it accessible to non-specialists. We’ll do this by constructing simple-to-use web platforms that are well connected to existing tools and by *making the system fully automated*’ (Blog post, May 17 2013).⁸¹

Among the most frequent misrepresentations of revenue management is the idea that the determination of prices consists essentially of endlessly getting their levels moving randomly. In fact, account managers rely on rational, if sometimes contradictory, pricing scripts, such as this rule whereby a steep increase in the number of reservations taken from one day to the next (the pickup) demands an

⁸⁰ Muniesa, Fabian, « Un robot walrasien. Cotation électronique et justesse de la découverte des prix », *Politix*, 13 (52), 2000, p. 121-54.

⁸¹ On pourrait multiplier à l’envi les passages qui soutiennent le programme d’une industrialisation du revenue management comme dans cette note de blog datée du 27 avril 2013 : ‘PriceMatch aims to *industrialise yield management*, a system of fixing prices based on reservations, as used by big transport companies, for example. PriceMatch offers a *completely automatised web platform* that calculates demand predictions and gives price recommendations to our clients, sold as Saas and very easily adaptable to a variety of sectors.’ Ou encore dans cet extrait (du 5 juin 2013): ‘PriceMatch has given itself the objective of *industrialising and democratising yield management* for independent hoteliers, to help them have a head-start with their clients and get a greater part of the consumer surplus by selling their rooms at the optimal price.’

increase in prices, that facilitate the decisions that they make at different stages of the price production process.⁸² But, just like everyone else in the start-up, the ‘one sole objective’ of account managers is commercial.

23 June 2014. It is 9:12 when the weekly meeting begins. Fifteen minutes early and among the first to arrive, I choose to set up at Augustine’s table, back to the wall, laptop on my knees, so that I can take notes comfortably. There are around 15 people around the table (including the author); two others, Alexandre and Ines, arrive part-way through. Of the five founders, only two are present: Julien (who is chairing the meeting) and Elias. Someone murmurs to me that the rest are on a ‘business trip’. Julien begins the meeting by going through the agenda. Beyond the usual round table, the focus will essentially be an email sent by Baptiste yesterday (which I hadn’t received at that point), that I reproduce in full below:

‘Hello all,

You will have noticed that there are more and more of us at PriceMatch. I just wanted to clarify with everyone the new official responsibilities that certain members of the team will take on:

- Léo will now be taking care of Product Management: he will be the person responsible for defining our Roadmap, and will be in charge of defining development priorities for the product.
- Ferial will manage the Account Management business unit without me from now on. The unit’s principal objective will be to get our clients to pay us.
- Yoan is now in charge of developing and managing all of our strategic partnerships with the PMS and Channel Managers. His mission is to: a) get the partners moving, b) negotiate partnerships, c) train partners in sales and account management, d) ensure that all partnerships created are productive.
- Basile is leaving the BU for Account Management and is now our CPO (Chief People Officer). His mission is to: a) recruit the right people at the right moment, b) integrate them and ensure that they are trained

⁸² Olav Velthuis defines these scripts as ‘a set of routines which function as a cognitive manual for the variety of pricing decisions.’ Olav Velthuis, *Talking Prices, op. cit.*, p. 117.

(this will be done by the BU themselves), c) ensure that there is a good level of communication between teams, d) maximise the productivity of everyone, e) ensure that we have all of the necessary metrics available in Salesforce and that the CRM is filled in properly.

All of that looks good on paper BUT in the short term absolutely all of us need to be concentrating on one sole objective: increase our turnover!

To achieve this objective:

- We must concentrate all of our commercial effort on hotels likely to pay quickly, i.e. hotels that have a PMS partner or that are already RFC'd, and that are in France. That means that, for the time being, we will be forgetting about all the *salons* and exotic conferences around Europe and elsewhere.
- AM [account managers] must help salespeople to secure more clients (talk to Adil about this, he will manage you).
- All developers must dedicate some time (around one day per week) to RFC to help out André and so that we can launch the 100 hotels waiting for a RFC as soon as possible.
- Everyone needs to give they're all and focus on the common goal.

Thank you for having read up to here, I'll very happy to respond to any question that you might have! Enjoy the weekend!

Baptiste'

'We have fun but at the end of the day we've gotta make money, and for that we've gotta make 'em pay'. This is how Julien summarises the words of his partner. There follows a debate on what clientele to target. Ferial, now the only supervisor for the account manager team, claims that 'it's the groups that take up all our time, because they have such specific demands,' and she notes that they have already spent 'six months on Balladin and the deal is still not done'. According to her, it's 'on the independent hotels that we should be focusing'. Alexandre, speaking for the sales team, retorts that 'yes, groups take more time for you, but for us signing up a little Parisian hotel takes a lot of time.' He continues by criticising Baptiste's proposal to focus on 'hotels that have already been "RFC'd"': 'You can't tell us to target PMSs', he claims. He fears having to give up on several prospective clients because

of a technical problem that, according to him, ‘should be sorted out sooner or later’ by the start up. ‘We already have enough obstacles as it is without giving ourselves more’, he adds.

Julien signals his desire to start going around the table, cutting short the debate that had flared up. Each person, although often the team supervisor, is invited to explain what she or her team has been doing this week and what is left to do. For the team of developers: Elias underlines the constantly growing constraints on time and human resources of the interface operations with the PMS (‘RFC’), indirectly responding to Alexandre’s earlier remark; Sébastien informs us that he has created a number of graphs that show a significant improvement in the accuracy of the algorithm; finally, Aurélien announces the collaboration between PriceMatch and Eventful, which will help get more detailed day-to-day information about local events likely to affect demand for a given hotel.

The telephone rings and Carine picks up. ‘Hello, Carine from PriceMatch!’

Meanwhile, Ferial talks about the Account management team’s week, which, according to her, has been very good: ‘We got going on 13 hotels last week, which is better than two weeks ago, and we got a group, Simply’. Nevertheless, she notes that none of the hotels are situated in Paris, slyly returning to the aborted debate on target clientele. ‘Concerning Operation Vendetta, we currently have 43 hotels that are not paying’.⁸³ I am led to understand that this evocatively-named operation

⁸³ It is important to understand that customers are typically divided into two categories: ‘clients in trial period’ and ‘clients who pay.’ A client in their trial period tests the platform in general for a period of one month (but it is sometimes much longer than this), a period during which the account manager who has been allocated this hotel will try to provide evidence of the reliability of the algorithm and of the quality of its outcomes (the price recommendations), by means of regular monitoring and frequent, sometimes daily, contact by phone or via email. If the hotelier is convinced, she will likely choose to take out a monthly subscription, for which the price is calculated on the basis of the number of rooms in the hotel (between five and ten euros per room), and will become a customer who pays. The latter will not require too much investment from the account management who will only examine the platform once in a while, usually weekly. The members of the account management team seek therefore to maximise both the conversion rate (for clients in their trial period) and the retention rate (for clients who pay).

consists in converting test hotels, in particular those that are still going strong, into paying subscriptions. Ferial promises that her team will do everything to get this figure down. To finish, she announces a decisive meeting with the negotiators from Balladin next Thursday.

Next is Basile's turn. Freshly crowned with his new responsibilities as director of human resources, he allows himself to make an observation on the state of the treasury: 'PriceMatch has enough to keep going for seven or eight months but we need to put more into raising new funds'. This is why 'it is crucial to reach our sales objectives'. Objectives that he then proceeds to remind everyone of, before announcing the arrival of a new recruit among the account managers, Samantha.

For the sales team, Alexandre, who has made himself spokesperson in the absence of Adil, assures that the sales effort has been refocused on the Paris market, and seems to therein imply that he hasn't given up on targeting large groups. Concerning Salesforce, the client management software recently bought by the start-up, he notes that 'we are still in the early stages' and 'there are lots of problems for accessing the metrics that need to be sorted out before the software can be really efficient.' Finally, Alexandre announces the imminent creation of the 'Yield Academy', a series of seminars about revenue management aimed at hoteliers, given by a specialist from the hotel sector and organised by PriceMatch. Augustine, head of marketing in the start-up, was clearly not in the loop and is unsettled by this announcement. She makes a fairly vague proposition of a piece for the blog and the organisation of some event at some future point. The meeting finishes with that. It is 9:38. The staff members return to their post in a ballet of office chairs.

Far from being neutral and technical, the work of account manager constitutes 'a form of rhetoric: its purpose is not to inform but also to convince,' and presupposes the construction of narratives designed not simply to 'make sense' of a particular level or a variation of price, but which are also important as a way to 'document or establish the *legitimacy*' of the algorithm.⁸⁴ It is one thing to find the right price, quite another to make it accepted by the hotelier and, even more so, to fit with the diversity of customers. 'Whenever we personalise the platform, in

⁸⁴ Bruce G. Carruthers and Wendy N. Espeland, 'Accounting for Rationality: Double-Entry Bookkeeping and the Rhetoric of Economic Rationality,' *American Journal of Sociology*, 97 (1), 1991, p. 31-69, p. 35 (quote).

general, we want the platform so that it looks right for us,' explains Lucas, an experienced account manager in the team. 'Then we ask the client if he or she is happy with it. And depending on the feedback, we make changes so that it's more coherent with the client's pricing policy' (Interview, 5 August 2014). However, the technical mastery of the platform by the account manager to calculate a hypothetical optimal level of price is of little help whilst the hotelier gives the product the cold shoulder; and it is only after the account manager has managed to make her use the platform that it becomes possible to convince her of the very technical nature, or efficacy, of the algorithm. Recall Ferial's comment: 'you always have clients who don't connect,⁸⁵ so if you send them a little email saying "on this date you're already 80 percent occupied, you should push your price up," that gives them a reason to connect, to get interested in the platform' (Interview, 22 August 2014). Thus, adherence comes prior to belief. But, just as scepticism pertains to the belief in magic⁸⁶, hoteliers are often not duped by the possible manipulations by the start-up with regard to the price recommendation. In fact, the simultaneous belief in the recommended price, the algorithm, and more generally revenue management is an 'ambiguous belief,' tinged with scepticism and doubt; a path that lead hoteliers to believe not because 'they're not exactly all Einsteins' as suggested by one hotelier about the other hoteliers, but on the contrary according to a plan of a rationality that

⁸⁵ This information is known by the account managers who have access to a dashboard showing, among other elements, for each user of the platform, the number of times the hotelier logs on during the month as well as the number of recommendations she has followed.

⁸⁶ 'Scepticism is included in the pattern of belief in witchdoctors. Faith and scepticism are alike traditional. Scepticism explains failures of witchdoctors, and being directed towards particular witch-doctors even tends to support faith in others.' Edward E. Evans-Pritchard, *Witchcraft, Oracles and Magic Among the Azande*, Oxford, Oxford University Press, 1937, p. 193.

one can refer to as Pascalian: the hotelier believes because fundamentally ‘we never know.’⁸⁷

I could quote entire pages of filed notes in support of this notion of scepticism. I will make do with one excerpt (from 2 July 2014) in which Feriel give the anecdote of a particularly painstaking hotelier that she had to deal with: ‘I had a hotelier who kept questioning our recommendations. He was always looking for problems to see if the rec was right, and how we made our recommendations. Honestly! Luckily they’re not all like that. One day, he was trying to find the Achilles heel and he put his price at 2000. His average price is 80-90. So he said: “Ah! Your recommendations are wrong!” Because the algo the next day had recommended like 1900. But we were trapped, because the algo does an average of the previous days – the three previous days. That’s why you have to always check the platforms.’

‘Your Recommendations Aren’t Right’

Richard C., 37 years old and owner-manager of a hotel since September 2011, was one of the very first clients of the start-up. His father, in his role as head of business angel funds at Science Po, was president of the incubator jury when the boys from PriceMatch came to present their project: ‘Originally they wanted to fill football stadiums, like what happens in the USA.’ ... ‘My father told them, and he was right, that there was more potential in hotels. In Paris, there aren’t many football stadiums but there are 1600 hotels. So my father naturally nudged them towards the hotel business, and introduced me to them.’

Callegari seems to have never left the well-heeled neighbourhoods of western Paris. His professional life, his ‘history’ to use his expression, has been lived in a sort of ‘silver triangle’⁸⁸ drawn between the metro stations Pont de Neuilly and

⁸⁷ For a recent analysis on ambiguous beliefs, see, for example, Julien Bonhomme, *The Sex Thieves. The Anthropology of a Rumor*, Dominic Horsfall (trans.), Chicago IL, HAU Books, 2016 [2009].

⁸⁸ The « golden triangle is a part of the Champs-Élysées neighbourhood in the 8th arrondissement of Paris, marked out by the avenues Montaigne, Champs-Élysées and George-V, and which is home to very rich families, businesses and luxury shops.

Trinité and the RER station Avenue Foch: After studying economics and management at Paris Dauphine university (Avenue Foch), where he got a DESS in telecommunications, he worked for around ten years at Sony Music Entertainment (Trinité-d'Estienne d'Orves); but the lack of professional opportunities in the music sector led him to set up as a hotelier (Pont de Neuilly). 'I had the opportunity to take over a family business, and so I got into that, four years after, in 2011.'

The establishment, for a time 'Hotel du Château' then renamed 'Le Bon Hôtel', is located in Neuilly-sur-Seine, a very rich town just outside central Paris; the fact that it is so close to the business neighbourhood la Défense means that its clientele is 'professional'. A three-star hotel when he took it over, he got his fourth in 2014 after a long period of renovation work; the hotel now has over sixty rooms, which makes it, in metropolitan France, a large independent hotel.⁸⁹

In April 2012, Callegari met Baptiste, Adil and Timothée at his hotel. But it was with Baptiste that he says he had 'the most direct relationship. Maybe because of the three he was the one that was most at ease, not technical, but in terms of relationships and business.' Despite his short experience in the hotel business, Callegari had already worked with a revenue management company, e-axess, with whom the previous owner had worked, but the experience seemed to have finished badly: 'It was supposed to be revenue management; in fact it was a con. I understood that very quickly so I terminated the contract.' But he liked the boys from PriceMatch and following the meeting he accepted to become their first pilot business.

Callegari tells me: 'At the time, they didn't know the hotel business.' ... 'So I taught them a few things: about the importance of Topsy and Availpro or other competitors with whom I worked; about the tools that hoteliers use. We talked about this and that. I gave them a few ideas and then they went away and got to work.' ... 'I gave them my figures for the three years I'd been owner and the forecast for the year; they put them in the machine; and very quickly they gave me some' ... 'recommendations. For a little more than a year, I received the results, sheets on excel sent daily.' ... 'I played the game: I asked about the accuracy of

⁸⁹ According to Insee, the average independent hotel in metropolitan France has 25 rooms (compared to 80 rooms for a chain hotel). Florent Favre, «En 2014, une chambre d'hôtel sur deux appartient à une chaîne», *Insee Première*, 1553, June 2015.

their suggestions.’ ... ‘Very quickly I said to them: ‘Your recommendations aren’t right, they’re not always reliable, they’re not bad but they’re lacking this and that.’ So we worked on them regularly.’

By the summer of 2014, Le Bon Hôtel was still important in the life of the start-up. For example, it is the only hotel whose ID number all the engineers knew by heart: 1018.⁹⁰ And for a reason: this is the establishment in the company’s register whose records go the furthest back; so it tends to be present in any tests that PriceMatch does. Notably it was from the first performance tests on Le Bon Hôtel that the following slogan was born, used on all the start-up’s marketing material: ‘Increase your RevPAR by 7.2% on average! ». (Interview, 8 December 2015)

⁹⁰ The number is easy to remember: 10/18 is a French publishing house that publishes books in pocket format—books of around 10x8 centimetres, hence the name.

4. The Rhetorical Logic of Algorithms

Even if the platform is overflowing with many and various data, more or less treated and formatted in dynamic tables and colourful graphs (price of competitors, demand segmentation, performance indicators, etc.), the price recommendation remains the key information, in the eyes of the start-up's members, because it justifies both the technical credentials of the product and the designation of 'innovative company' granted to this organisation. So as Alexandre, the ace salesperson at PriceMatch and a 'sociological case' according to Ferial, likes to say to clients: 'Following your competition, it's the lowest level of sophistication of yield management, because if your competitors are wide of the mark, you're going to be too' (Field notes, 15 July 2014). Without its algorithm for determining the optimal selling price, the rest of the data would be of little value, as Julien, cofounder and head of the front-end unit, notes: 'It's true that a big part of the value of the product, it's not the scientific algo, impressive, made by the engineers; it's displaying the data, giving insights about what's going on. Have you taken lots of reservations? Have competitors changed their prices? Have you got more Americans this year than last year? Do they spend more or spend less? Etc. That, that's pretty valuable for the guy.' ... 'The data, he's got it all there in his PMS but it's impossible to display it. Either he can't because the PMS doesn't have the right export function, or it does but it's old and rubbish. So what we do is we access the raw data in the PMS, which may or may not be fairly convoluted, and then we process it to make it look nice. Have a nice dashboard, nice visuals of the data; the hoteliers, they love that. But the algo, it does give us a certain scientific legitimacy. You say to yourself: 'We haven't just made some jumped-up rate-shopper, we've got an algo, we've read white papers.' That gives some real credibility' (Interview, 18 September 2014).⁹¹

⁹¹ In fact, one could affirm in the case in point that the form (the user interface) matters just as much as the substance (the accuracy of the recommendation) as both share only one goal—justification. This excerpt from an interview conducted with a hotelier and longstanding client of the start-up is typical on this count: 'The PMS today, in particular Topsy, offer a bit more analysis. Topsy will analyse sales, length of stay, forecast for however many days, so help you to understand the results so far.' ... 'The PriceMatch

Although it occupies only a small fraction of the development team—in the summer of 2014, only two engineers, Charlie and Maxime, out of eight, were fully dedicated to it—the algorithm deserves a close analysis. First, because it shows that a price and more generally value are social and organisational constructs. But more importantly, being located halfway between trade and the actual ‘science’ of pricing, the algorithm allows us to decipher the complex and apparently contradictory blend of technique and rhetoric, prediction and performative gesture,⁹² of science and politics, that gives the work of fabrication of prices its distinctive properties and capacities in the specific context of the start-up.⁹³

model gives figures. That is their aim and their one and only desire: give figures. It’s true that today, PriceMatch gives something more refined, that’s more and more the case—they didn’t do that at all at the beginning, by the way. So they explain prices by certain events, by competitors, etc.’ (Interview, 8 December 2015). To get a better idea of the increase in these ‘refined’ elements, see Appendix D at the end of this document, which traces in images the transformation of the platform’s user-interface.

⁹² Michel Callon, ‘Introduction: The Embeddedness of Economic Markets in Economics,’ in Michel Callon (ed.), *The Laws of the Markets*, Oxford: Blackwell, 1998, p. 1-57.

⁹³ For sociological empirical studies on algorithms, see Fabian Muniesa, *Des marchés comme algorithmes: sociologie de la cotation électronique à la Bourse de Paris*, PhD Thesis, Paris, École Nationale Supérieure des Mines, 2003; Daniel Beunza and David Stark, ‘Tools of the Trade: The Socio-Technology of Arbitrage in a Wall Street Trading Room,’ *Industrial and Corporate Change*, 13 (2) 2004, p. 369-400; Donald MacKenzie, *An Engine, Not a Camera: How Financial Models Shape the Markets*, Cambridge, MA: MIT Press, 2006; Martha Poon, ‘From New Deal Institutions to Capital Markets: Commercial Consumer Risk Scores and the Making of Subprime Mortgage Finance,’ *Accounting, Organizations and Society*, 34 (5), 2009, p. 654-74; Alex Preda, ‘Tags, Transaction Types and Communication in Online Anonymous Markets,’ *Socio-Economic Review*, 11 (1), 2013, p. 31-56. Donald MacKenzie provides a short review for this nascent sociology of algorithms in Donald MacKenzie, ‘A Sociology of Algorithms: High-Frequency Trading and the Shaping of Markets,’ working paper, 2nd draft, June 2014.

LES ALGORITHMES PRICEMATCH

NOS BASES STATISTIQUES

RÉGRESSIONS ARMA

MODÈLE OLS

TESTS CORRECTIFS

KERNEL-MATCHING

STATISTIQUES
BAYÉSIENNES

ÉQUATIONS
DE BELMANN

SIMULATIONS
DE
MONTE CARLO

RÉGRESSION
ÉCONOMÉTRIQUES

FONCTIONNEMENT DE NOS ALGORITHMES

TAUX D'OCCUPATION

BASE DE DONNÉES

PRIX MOYEN



- PRÉDICTION DU CHEMIN DE RÉSERVATION
- PRÉDICTION DU RYTHME DES ANNULATIONS FUTURES
- ESTIMATION DE LA MATRICE D'ÉLASTICITÉ-PRIX DE LA DEMANDE
- ESTIMATION DU CHEMIN DE PRIX OPTIMAL
- AJUSTEMENT MARGINAL DE LA RECOMMANDATION EN FONCTION DU PRIX DE VOS CONCURRENTS



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PRICE MATCH



Figure I.4.1. 'The PriceMatch algorithms' (Blog note, 2 May 2013).

1. Demand Estimation

The first function of the algorithm is the demand estimation model. It is divided into two main functions: a) long-term forecast and b) short-term forecast. *Long-term demand* (a) is estimated using the booking history extracted from the property management system (PMS) of the hotel.⁹⁴ Each arrival date is characterised by an occupancy rate and a number of features, such as day of the week, month of the year and year, holidays, and local events. A linear model⁹⁵ is used to evaluate the effect of the characteristics of a date on the occupancy rate. Once calculated, the regression coefficients are used to forecast the occupancy for dates in the future. Graph I.4.1 shows that occupancy is affected by seasonal variations—summer, for example, is an off-peak period for this particular hotel. Several nights yield records for attendance, such as in the case in point Valentine’s Day, New Year’s Eve, or the week of the Paris Motor show. Others, on the contrary, are marked by particularly low occupancy rates, for instance holidays, like Bastille Day and Armistice Day. A close-up view on January shows the day-of-the-week variations throughout the month—peaks during the week and troughs at weekends—, indicating that the hotel in question is aimed at business rather than leisure customers (see Graph I.4.2⁹⁶).

Historic data are also used to obtain two standard reservation paths: a weekday’s standard path and weekend day’s standard path. Both reservation paths

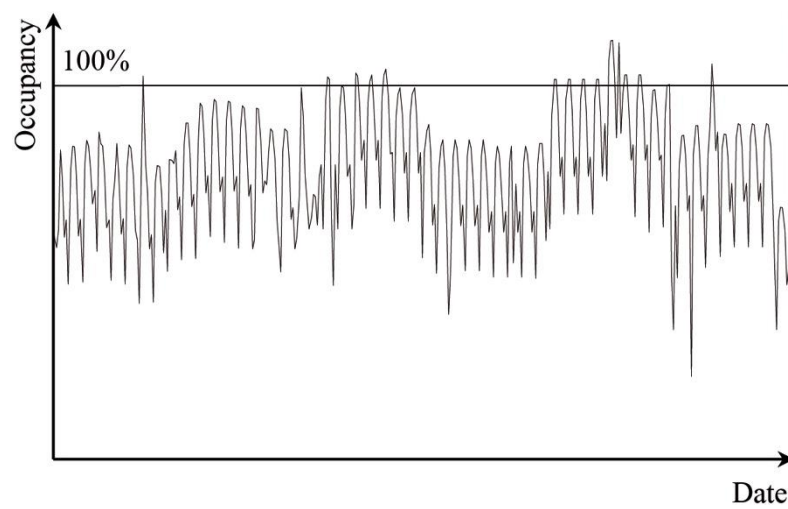
⁹⁴ A property management system, or PMS, is a software application used by hoteliers to cover the key management functions in a property. These include front office (reservations and sales, invoicing) and back office operations (provisioning, staff management and payroll, and accounting, particularly through its provision of some key performance indicators).

⁹⁵ In statistics, this linear model is referred to as an analysis of covariance, or ANCOVA. It is a regression model in which the dependent variable y is quantitative but all the explanatory variables X are dummies or qualitative. It indicates whether the presence of a phenomenon x_k increases or decreases significantly the value of y , ‘all other things being equal.’

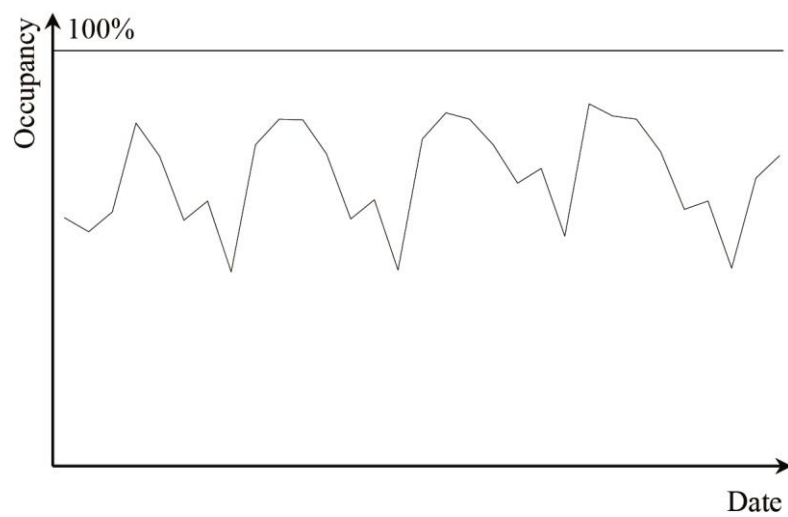
⁹⁶ All graphs represented in this section have been developed from the data, as of 24 November 2012, PriceMatch’s first pilot hotel.

are the average evolution of reservations taken over the booking period. Both are normalised by dividing by the final occupancy rate. The *short-term demand* forecast (b) is based on such reservation paths and inventory information supplied by the channel manager. Depending on the number of days before the arrival date and the actual occupancy, the final occupancy is estimated, and this estimation is repeated on a daily basis. The results presented in Graph I.4.3 are rather counter-intuitive from a revenue management perspective. Central in most models is the assumption that leisure customers tend to book earlier than business customers. This is already mentioned in Kenneth Littlewood's seminal study on revenue management: 'Surveys indicate that there is a strong tendency for low-yield passengers [*leisure passengers*] to book earlier than high-yield passengers [*business passengers*].'⁹⁷ This is probably the modelling assumption that is most taken-for-granted among revenue and pricing managers. Yet, if one accepts that hotels are more likely to be populated by businessmen on weekdays and by a leisure clientele on weekends, the standard paths shown here in fact come to challenge the 'lowest-class-books-first' assumption: reservations for weekdays, which are likely to be made by leisure customers, seemed to be taken earlier. Another observation is that, as it appears, cancellations were less likely to happen at weekends—unlike the weekdays curve, the weekend curve is continually growing. Finally, when representing the short- and long-term demand forecasts together, it is easy to see that, for the short-term prediction, cycles are more pronounced; they are above all more irregular (see Graph I.4.4).

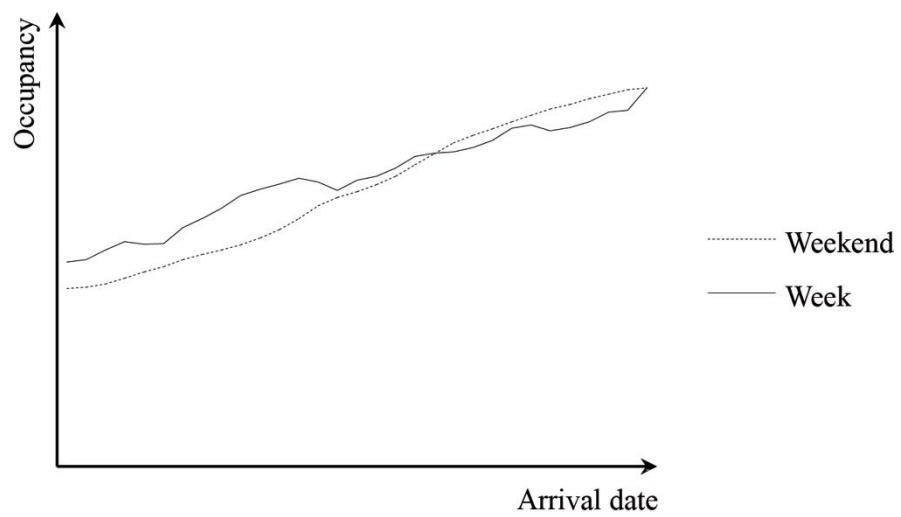
⁹⁷ Kenneth Littlewood, 'Forecasting and Control of Passenger Bookings,' *Journal of Revenue and Pricing Management*, 4 (2), Apr. 2005 [1972], p. 111-23, p. 118 (quote).



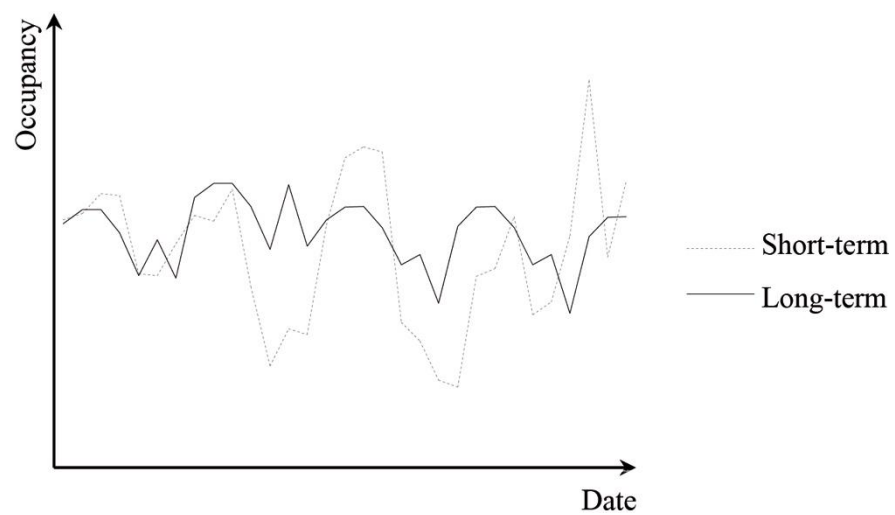
Graph I.4.1. Long-term prediction for occupancy, 2012.



Graph I.4.2. Long-term prediction for occupancy, January 2012.



Graph I.4.3. Normalised standard paths for week and weekend, 30 days prior arrival date.



Graph I.4.4. Short-term versus long-term occupancy forecasts,
24 October to 24 November 2012.

From the long- and short-term forecast thus obtained, the final demand forecast is calculated—for the coming thirty days at the time, then over a three-month horizon. This proceeds in the following adjustments: first, the two demand forecasts are combined (following a linear combination, the short-term forecast gradually gains in weight in relation to the long-term forecast as the arrival date approaches); a second adjustment consists in taking into account possible cancellations (it is assumed that the closer the arrival date, the less likely a reservation will be withdrawn, and this is formalised by a simple linear relationship).

Demand estimation is probably the area of the algorithm where most of the improvements have been made since the launch of the platform and it was still being changed in the last few months prior to the takeover. The short-term demand forecast, for example, was completely overhauled at the beginning of 2014 to improve its effectiveness and to allow the establishment of a wider range of reservation paths. This is permitted by using a matching function to derive night-similarity measures. Nevertheless, the set of data on which to calculate the occupancy rate in the future has remained more or less unchanged. I will get back to this idiosyncratic use of available data in the next section. For now, I will turn to the optimisation part of the system.

2. Price Optimisation

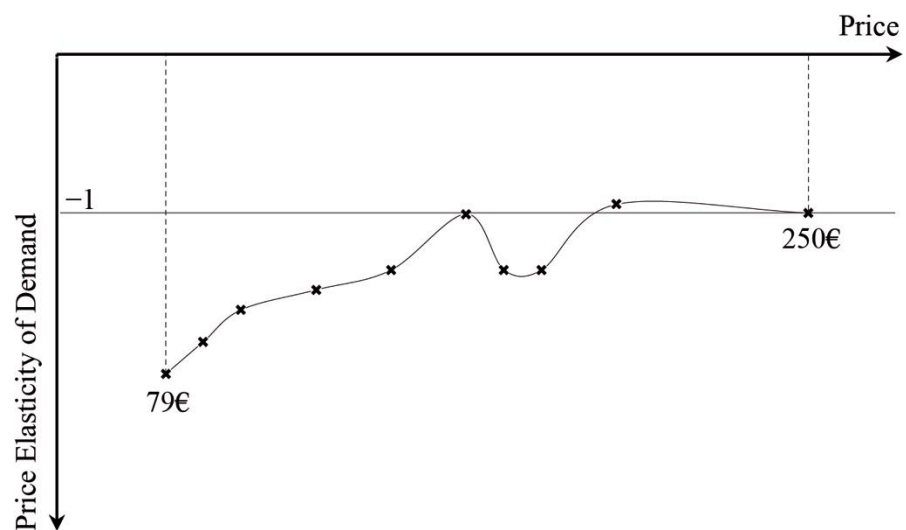
The careful reader will have noticed that something seems to be missing in the account I have just made of the demand estimation function: prices. As startling as it may be, my description is accurate. Information on prices is *not* used in the determination of demand. And yet, a brief review of the literature in operational research indicates that most of the statistical models do indeed rely on price data to estimate demand. One could refer to dozens of models in support of this statement. It is sufficient to mention the series of expected marginal seat revenue (EMSR) models, which are by far the most popular models in practice.⁹⁸ Indeed, both

⁹⁸ Peter Belobaba, ‘Application of a Probabilistic Model to Airline Seat Inventory Control,’ *Operational Research*, 37, 1989, p. 183-97; Peter Belobaba, ‘Optimal vs. Heuristic

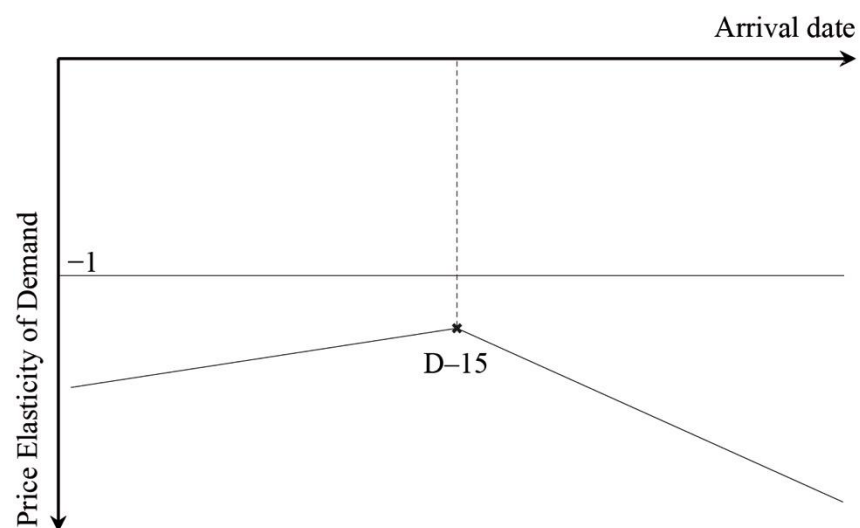
EMSR-a and EMSR-b heuristics, for example, assume two rate classes (or rate categories), associated with different levels of demand. Thus, in the model devised by Baptiste and Léo, the predicted final occupancy rate is calculated irrespective of the price at which reservations have been made.

In many respects, the solution that has been found at PriceMatch to solve the optimisation problem is original. Informed by their strong background in economics, and microeconomics in particular, the algorithm's architects chose to make their model rest upon the notion of price elasticity of demand. Léo specifies the relationship between demand and price: 'It is true that the point we project on the demand curve, which is an occupancy at a given price, is worth whatever it's worth. But the assumption was to say that, in the vicinity of that point, there was some elasticity that we knew about, thus allowing us to calculate, to approximate the demand curve in the vicinity of that point' (Interview, 24 September 2014).

Methods for Nested Seat Allocation,' presentation at ORSA/TIMS Joint National Meeting, November 1992.



Graph I.4.5. Price elasticity of demand as a function of price.



Graph I.4.6. Price elasticity of demand as a function of the number of days prior to the arrival date, 30 days.

The price elasticity of demand constitutes therefore the missing link between the demand forecast calculated in the first stage and the price recommendation. The so-called point elasticity of demand method should make it possible in principle to predict the impact of a change in demand on the equilibrium price. It uses differential calculus to calculate the price for an infinitesimal change in quantity at any given point on the demand curve. The optimal price, P^* , is equal to the absolute value of the first derivative of price with respect to quantity, dP/dQ , multiplied by the point's quantity, Q , and the elasticity, E_p . However, the optimal price can be computed only if the formula for the point-price elasticity, $E_p = f(Q)$, is known. The price elasticity of demand at PriceMatch is only approximately known:

Léo: The second component was the optimisation. So here, it was extremely basic, and still is a bit, in the sense that we kind of produced an elasticity matrix...

Vassily: You mean you made it up?

Léo: Yeah, we made up an elasticity matrix by taking figures from the literature that seemed right to us. (Interview, 24 September 2014)

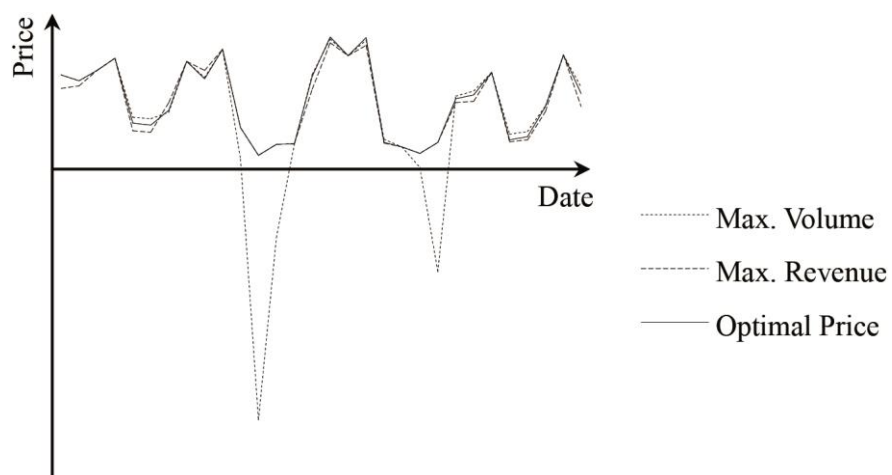
Although 'made-up,' the elasticity matrix follows a certain logic. The starting point is, as pointed out in the previous conversation, a set of price-elasticity values found in the literature in operational research, and in particular in one study which came to be known at PriceMatch as the 'Egyptians' paper.'⁹⁹ In this paper, the authors assume that the point-price elasticity is dependent on two main variables—the price of a hotel room and the number of days before the arrival date—and present an example of elasticity matrix. The matrix built by the people of PriceMatch is essentially derived from this example, and the missing values extrapolated. I have reproduced here the elasticity vectors thus obtained according to price (see Graph I.4.5) and as a function of time prior to arrival (see Graph I.4.6).

⁹⁹ This paper was published in an Egyptian academic journal: Heba Abdel Aziz, Mohamed Saleh, Mohamed H. Rasmy, and Hisham ElShishiny, 'Dynamic Room Pricing Model for Hotel Revenue Management Systems,' *Egyptian Informatics Journal*, 12 (3), 2011, p. 177-83.

Two observations can be made. Firstly, the non-linearity of the elasticity both in relation to prices and days prior to arrival. While on average the price sensitivity tends to decrease here as the price goes up, there are peaks and troughs along the way (see Graph I.4.5). Likewise, price elasticity of demand varies according to the number of days before the arrival date. Two stages can be distinguished: up to a fortnight prior to arrival (day-15), the demand for hotel rooms is less and less elastic; beyond this period, however, it becomes more and more elastic (see Graph I.4.6). Secondly, in both graphical representations of the data, price elasticity of demand is negative and seldom exceeds 1 in absolute value. This means that an increase in prices will cause a decrease in demand, and vice versa, as is the case for ‘normal goods.’ The model was not therefore applicable to the price-setting of suites and luxury rooms of five-star properties, or if one prefers of ‘luxury goods,’ for which the elasticity is by definition positive. This should not come as a surprise, given that the high-end segment of the hotel market does not constitute the target clientele of the start-up—luxury hotels already have a long history in using revenue management systems, and thus are believed to be much more difficult to acquire.

It is easy to understand how the optimal elasticity matrix must differ from one property to the next. It is well known that customers’ price sensitivity in the hotel industry is a function of, among other factors, geography, luxury, and size. It is clear, for example, that the customers who stay in higher-end hotels are far less price sensitive than those of lower-end hotels. To take account for differences in price sensitivity, values of the elasticity matrix should logically be adjusted according to each type of property. In spite of efforts to develop ad hoc values, the algorithm of PriceMatch makes use of *one single* elasticity matrix for determining the optimal price. ‘I tried to play around with the data we had,’ Léo says. ‘But I didn’t manage to find [*he corrects himself*]... We didn’t manage to reach conclusive findings on what elasticity values really are’ (Interview, 24 September 2014).¹⁰⁰

¹⁰⁰ In September 2013, PriceMatch announced in the company’s blog the development of a new method to determine the price elasticity of demand for each hotel type. However, the method was never implemented: the elasticity matrix remained the same for all



Graph I.4.7. Prices derived from three different strategies,
24 October to 24 November 2012.

PriceMatch's clients, whether located in Paris, in the provinces or elsewhere, independents or hotel chains, one-star or five-star properties, etc.

From this elasticity matrix, the optimal price can be calculated. In fact, three different prices are computed: the price that maximises occupancy, the price that maximises revenue, and the optimal price which is a combination of the two. Both the volume-maximising and revenue-maximising prices are determined for a given occupancy forecast and price elasticity of demand. A linear combination is then used to turn these two prices into one (see Graph I.4.7). This so-called optimal price is set for each room type as a function of the current occupancy and remaining days before the arrival date.

From a revenue management perspective, the determination of a price that maximises quantity seems supererogatory. Recall the seminal work of Kenneth Littlewood, which introduces the idea of maximising the revenue received on a particular flight, rather than maximising the number of passengers carried (cf. *infra*).¹⁰¹ The reason why the algorithm departs from such a fundamental principle is probably to allow for different degrees and types of strategies. In particular, it is important to understand that a volume strategy is by definition more conservative than a revenue strategy. Let me take an example. Take two hotels, A and B, of different sizes which both have one room to be filled only. Hotel A has a capacity of ten rooms while Hotel B has one hundred. Under these circumstances, the shortfall resulting from the room remaining empty is more significant for Hotel A than it is for Hotel B. Thus, hotelier A will be more likely to offer a lower price to ensure that the room is taken, whereas hotelier B will probably try to temporise to sell it at full price. In economic theory, it is said that manager A, who runs a smaller property, is more risk averse. Yet, we know that the overwhelming majority of hotels are independent businesses of small size. Moreover, these are the target clientele of PriceMatch. We understand now the relevance of calculating the price that maximises volume: it makes it possible to adapt the offerings to meet the needs of the customer base and it makes it possible to move the cursor to any strategy or tactic, either conservative or more aggressive, by simply altering a parameter on the platform.

¹⁰¹ Kenneth Littlewood, 'Forecasting and Control of Passenger Bookings,' *art. cit.*

3. Rules of Control

Once calculated, the optimal price is subjected to a number of control rules. Sometimes the purpose of these rules is simply to contribute to effective price adjustment, but rules are also important as a way to establish the legitimacy of the revenue management system. When used this way, a rule constitutes a form of rhetoric: its purpose is not simply to find the right price but also to convince and persuade.¹⁰² In the following, I will present first the ‘tactical rules’ (a), then the ‘rhetorical rules’ (b).

A first set of rules of control can be referred to as *tactical rules* (a), because it is concerned with the pricing tactic or strategy of the hotel. Tactical rules can be turned on and off at will by the members of the account management team. For example, the following rule according to which: if it ends in the digits 0, 1 or 2, then the price is rounded to the next lowest price ending in the digit 9. The underlying assumption of this rule is that certain prices have a psychological impact and tend to be perceived by customers as being significantly lower than they actually are, tending to round to the next lowest monetary unit. We know from retail pricing that prices such as 1.99 euros are associated with spending 1 euros rather than 2 euros. This is the basis of what is known as psychological pricing in the fields of marketing and economics. For a hotel room, this technique should make it possible in principle to increase the number of reservations, without significantly reducing the revenue for each sale, and thus to increase revenue.

Another example relates to price matching. Price matching is when retailers give you a refund of the difference between their higher price of a good and their competitors’ lower price for the same good. The so-called ‘one-euro-less’ rule makes it possible for a particular hotel to price-match its competitors by offering a lower price, and more specifically: if the next lowest competitor’s price is close enough (four euros or less), the recommended price is set at 1 euro less. (We note in passing how PriceMatch was a poor naming choice. Price matching is about

¹⁰² On the tension between the rhetorical and the technical, see Wendy N. Espeland, Bruce G. Carruthers, ‘Accounting for Rationality,’ *art. cit.* By rhetoric the authors simply mean techniques that are used to make a convincing or persuasive argument.

guaranteeing the lowest price. Revenue management, on the other hand, aims at charging each customer's maximum willingness-to-pay, or the highest acceptable price. By almost any measure, revenue management and price matching practices are therefore in contradiction with each other.)

Some features of the revenue management system at the SNCF¹⁰³ has been reported publicly by the company itself. In particular, we know that French national railway has adopted what is sometimes called by the actors an 'ascendant revenue management' rule. Such a rule makes it technically impossible for revenue managers to reopen lower-value discount classes, that is, to make prices go down.¹⁰⁴ A similar rule can be found in the algorithm of PriceMatch. But, unlike in the case of the railway, downward changes in prices were not completely prohibited in the start-up. Instead, they were allowed, under this rule, up to a certain limit. By default, this limit was set at 3 percent. By reducing this percentage, the hotelier will hope to secure sales by encouraging customers to make their reservations earlier on, as, by increasing it, she will give herself more flexibility in pricing decision to react to a fall in demand.

Then, *rhetorical rules* (b). Their purpose is to convince users of the platform that the recommended price is right. Léo states it very clearly:

A big chunk of the algorithm is about implementing rules so that it addresses not only the optimisation problem but also the concerns of the hotelier. ... We tried to respect constraints which are not necessarily aligned with the optimisation interests of the hotelier. Somehow, if we provide a hotelier with a recommendation that seems absurd to her, it is the whole tool that is being put into question. So you need to find the right balance between actually optimising the selling price and reassuring the hotelier. (Interview, 24 September 2014)

¹⁰³ *Société nationale des chemins de fer français.*

¹⁰⁴ Jean-Michel Normand, « Voyager à tous prix : la fabrique des tarifs », *Le Monde Magazine*, 8 April 2011. In other instances, however, the SNCF admitted that deep-discount seats could be made available for sales again when faced with a large number of cancellations.

Indeed, several rules were developed to control for the possible bugs and other defects which may arise from the optimisation model. Graph I.4.7 gives an idea of the kind of defects that need to be identified and corrected (see above). We can see that, when maximising occupancy, the algorithm returns a few negative price values. Negative values mean customers should be paid to accept to stay in the property. It is easy to imagine how users of the platform would react to such price recommendations, hence the use of a simple rule of control that will avoid displaying such negative values on the platform.

Another set of rules situates the final recommendation within a network of prices to which it is compared and from which it is derived.¹⁰⁵ These ‘reference prices’¹⁰⁶ include, among others, the minimum and maximum prices, competitors’ prices, actual price, and recommended price (of the day before). The price is first compared to the price list of a particular hotel, in particular the minimum and maximum prices. The aim of this series of rules is to ensure consistency in all prices offered by a particular hotel. A rule is used, for example, to make sure that the recommended price will never be below the minimum price nor above the maximum price, or rack rate. Likewise, another rule guarantees that a double room will always be more expensive than the single room, and so on for the different room types of a property.

The price is also determined in relation to the median price of neighbouring hotels, so that ‘the hotel is correlated with its market to some degree,’ as the engineers justify. By default, the correlation coefficient used here is set at 20 percent, but the account managers are able to modify this parameter from the setting tab of the platform. Most of them consider that 30 percent is the right level. And

¹⁰⁵ Michel Callon and Fabian Muniesa, ‘Economic markets as calculative collective devices,’ *Organization Studies*, 26, 2005 [2003], p. 1129-250; Sandrine Barrey, « Formation et calcul des prix : le travail de tarification dans la grande distribution », *Sociologie du travail*, 48, 2006, p. 142-58.

¹⁰⁶ For an application of the notion of ‘reference price’ for the contemporary art market, see Olav Velthuis.

they can even adjust weights attributed to each competitor to take account for the heterogeneity of the hotel's set of competitors.

Moreover, the price is seen together with past recommended prices. More precisely, in the prototype version of the algorithm for example, the differential between the price for a particular day, P_d , and the recommendation of the day before, P_{d-1} , could not be greater than 10 percent. By means of this rule, the engineers of PriceMatch sought to provide against erratic variations in recommended prices from one day to the next, which would leave, according to them, a bad impression on the users, and ensure a sense of consistency and continuity over time in the recommendation.

Finally, the price is derived too from the actual price. The actual price is the listed or posted price, not the recommended price. It is the price actually set by the hotelier. A rule is used to make sure that the recommended price is no more than 15-percent different from the average actual price of the last three days. Again this number of days is a parameter in the model and can be modified at will by the account managers. According to Léo, this rule pertains to the micro-negotiation which is being played out with the users of the platform: 'Some hotels are charging way too much, but we're going to say to them that they're charging a little too much, and despite that they won't necessarily follow us. So, knowing that they don't lower [their prices] when they are told to lower a little, if they were told to lower [their prices] drastically then it's unlikely that they would listen to us' (Interview, 24 September 2014).

With regard to algorithms, the order in which the rules intervene matter. This order tells us something about the form of the relationship between the start-up and its customers. In the case in point, the algorithm must respect a fundamental priority: the price must be close enough to the average actual price. If this condition is satisfied, a second priority can intervene: the price must be close enough to the previous recommended price. Other additional priorities I have reviewed above can come into play if the price interval thus delimited allows it. What the order of rules seems to imply here is that the PriceMatch's algorithm gives high priority to customer satisfaction. It incorporates in its architecture the slogan, used and

popularized by a hotelier, César Ritz, according to which ‘the customer is never wrong.’

‘Success Stories’

A report on a project in progress for the development of a new function in the platform, this subsection presents the main stages in the detection process of the so-called ‘success stories’, that is, these dates for which the algorithm has performed best. This function has been developed by Cédric and the following excerpts are from his internship report presented at Art et Métiers ParisTech in April 2015.

Presentation of the task

One of the major problems when offering a decision-making service is being able to prove the worth of the tool that is developed. One way is to use a priori methods of projections based on a specific scenario: by putting the price at 100 euros, turnover is estimated to be 1000 euros, whilst if the price is put at 80 euros, the turnover is estimated at 1200 euros. Another method is to prove the tool’s worth a posteriori, once the trajectory has been observed: by applying our recommendation of 100 euros, you have filled your hotel and got a turnover of 1300 euros. This work is absolutely necessary for two reasons: firstly, the account managers must be able to convince the client of the benefits of the product, so that the client does not cancel the contract (the service is offered on a non-binding basis), and then the account manager must be able to persuade the client that she must follow our recommendations. ... Highlighting the results obtained with the help of the tool allows us to demonstrate its worth. This work following up clients is done by the account managers, but they have a large number of clients to manage, and it is difficult to do all of this work manually because it is very time-consuming as well as being subjective. It is also worth noting that the majority of these account managers have a master’s in revenue management, and therefore they have a good understanding of dynamic pricing, and the different metrics used in defining tariffs (price curves, the trajectory of the occupation rate, etc.).

The idea suggested by Baptiste W. (CEO of PriceMatch) was therefore to create a tool that would detect nights when the company had made money for hoteliers: known as ‘success stories’. My job was to create and implement this tool, starting from scratch. I had final clients (the hoteliers), intermediate clients (account

managers, who had to validate my tool's suggestions), and one requirement: find the right nights. In order to properly demonstrate this requirement, here are two nights, one very good, and one very bad.

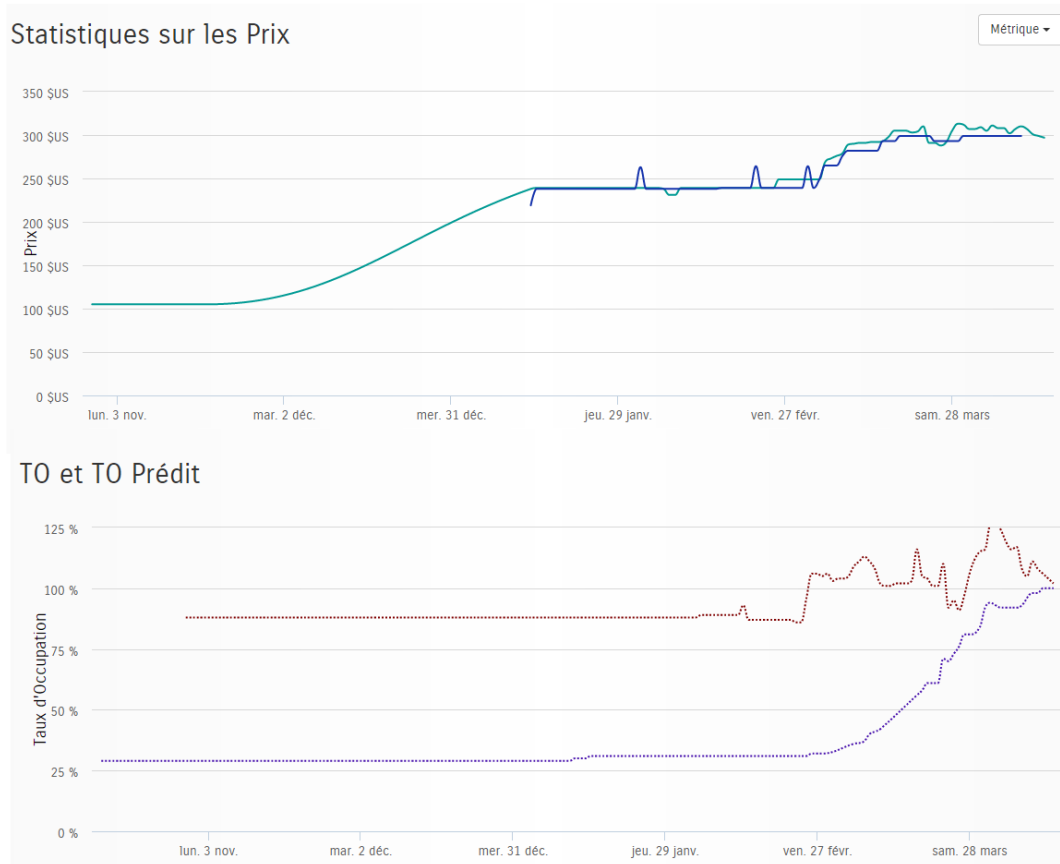


Figure I.4.8. Occupation rate metrics and price for a ‘good’ night.

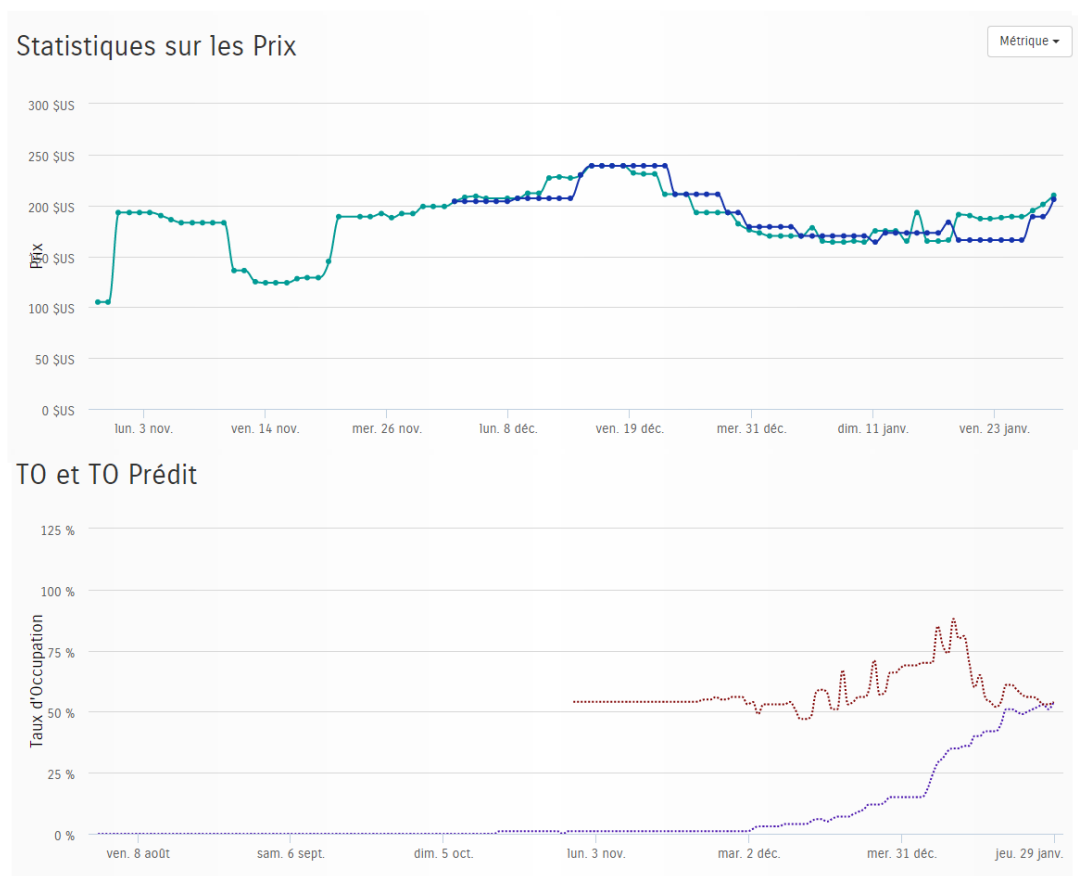


Figure I.4.9. Occupation rate metrics and price for a ‘bad’ night.

It is clear that these nights have completely different characteristics, and a tool should be able to at least filter out all of the average nights that don't stand out. Given the large amount of subjectivity involved, there is no perfect response or algorithm: so I chose to follow a 'lean start-up' approach with the aim of developing a minimum viable product (MVP) with this new functionality, then to start over and gradually try to improve it.

...

The task

To best complete the task, I began by making sure what was needed. Therefore I organised meetings with the account managers to talk about the subject, because these people would be my primary users, but also because their wide practical knowledge of revenue management was a gold mine: they represent the expert opinion to be coded into the algorithm. I therefore used them for two purposes: their experience as a user, and their knowledge as an expert. Once I had done this early research, I formalised it into a functional specification.

One of the most important steps was the definition of the key performance indicators (KPI) of a past night, in order to compare different nights. The most important indicators were the following:

- Gap between the hotelier's prices and our recommendations
- Final occupation rate
- Average price
- Ascendant yield
- Increase in revenue compared to the previous year, if available
- Number of recommendations followed by the hotelier

Having done this, I was able to pass to the first phase of implementation, and I created a code linked to these metrics and the functionality, as well as corresponding unit tests. Once the first version of the functionality was implemented, I tested it on several hotels and asked for feedback from some account managers, trying to test as many different scenarios as possible.

This allowed me to identify the weaknesses in my algorithm, and I added a few metrics, and modified the weighting between them. In this way, we constantly

improved the functioning of the algorithm so that it met the needs of the account managers.

Results

The results, even if they are subjective, seem satisfactory, and the algorithm will go through a phase of web development so that it is directly accessible to account managers on the platform.

...

The tool should allow account managers to concentrate on recommendations to make for the future, and no longer waste time going over past nights so that they can show clients the product's value. Eventually, the idea is to automatically generate account managers' feedback. They could validate or not a night as a success story, and perhaps automatically send emails to clients, that feature these nights. That said, before going this far it is necessary to ensure that the algorithm works effectively, because sending the wrong nights to clients would be disastrous and completely discredit the company.

Personal feedback on the experience

The task gave me an opportunity to initiate myself in the development of an innovative product, and forced me to keep to the strict minimum and then redraft, rather than try to find a perfect solution directly, which would have been my natural preference. But this approach is not realistic when the objective is so complex and subjective, and I had to learn to calibrate my demands with feedback from the people who would be using it, and not just go with what I personally thought was the best option.

The expression a 'good date,' or 'good night,' which comes up frequently in the vernacular of the start-up, denotes this idea whereby there is, at least in the minds of actors, a 'normal' behaviour of prices, which engineers and account managers of PriceMatch seek to identify, with the additional difficulty that what is normal for some can be considered as deviant by others.

Algorithms as a Moral, Rhetorical and Technical Device

A hybrid figure between theory and practice, and between research and action, the algorithm produces what Fabian Muniesa calls ‘effects of rightness’ [*effets de justesse*]¹⁰⁷ quite specific to revenue management that can be articulated or discerned only in concrete situations. ‘Putting an algorithm into place’ is an ‘explicitation work,’ which expands to wider complexity and the need to establish choices between several possible states.¹⁰⁸ In the first place, the algorithm is a search for a compromise, notably from a moral point of view; the specific organisational context in which it spreads out results in operations of compliance with the practices and moral values in use. The following interview excerpt illustrates various ways in which account managers, as well as hoteliers, have to deal with this issue of morals in their work:

Vassily: At PriceMatch, you don’t necessarily do ascendant yield.

Carine: We have the option. We can do it for clients. Personally, I’ve got it activated for two clients. For me, ascendant yield works. *It teaches the consumer to always book early, which helps us*: the more you have early reservations, the easier it is to manage fluctuations, make estimations, that kind of thing. *I mean it’s more an advantage for us than for the consumer*. But the downside is that the algorithm hasn’t necessarily been designed for ascendant yield. A hotel always runs the risk of losing a group reservation, or loads of reservations at once, meaning it has to lower prices. If that happens, we’re stuck, because the rec isn’t going to have taken that into account, and will tell the hotel to keep raising the price. So it’s more that the algo needs to be improved, to be more reactive. Because at the moment it’s just a condition that says: ‘you won’t make the price lower than yesterday’. It needs to be able to adapt to peaks and troughs of demand.

¹⁰⁷ ‘A configuration with an algorithm gives a special effect of efficiency and fairness, that we call ‘a rightness effect’: a ‘rightness effect’ but at the same time with a technical sense, like when we say that the answer to piece of arithmetic is ‘right’.’ Fabian Muniesa, *Des marchés comme algorithmes: sociologie de la cotation électronique à la Bourse de Paris*, PhD Thesis, Paris: École Nationale Supérieure des Mines, 2003, p. 288.

¹⁰⁸ Fabian Muniesa, *ibid.*, p. 287.

Vassily: You said that in Spain, your hotels are used to practising descending yield; that they drop the prices at the last moment

Carine: I have hotels that work very very well. But I've got three hotels in Barcelona that fill up massively in the last couple of days. They try and do a sort of medium price: when they have a few reservations coming in, they're happy, they put up the price. But if they want to be full, they have to drop the price. ... We tried with one hotel starting low and then going up little by little. We tried on three different dates, and on all three, the OR was in the red. So it's tough. In my opinion, ascendant yield, it makes sense when activity is good, in cities where you're fairly full all year, at least to have a base. Like Paris. Barcelona no. Barcelona's just tourists. Summer in Spain, it's just tourists.

Vassily: Hold on, hold on! You said there's just tourists. But doesn't that contradict the idea, which is pretty widespread in revenue management, that tourists reserve earlier than business?

Carine: That depends on the destination. Barcelona, you have at least five flights a day, even more. You can go just like that: 'I'm going to go for a weekend there'. And generally, it's not expensive. You tell yourself that you can always find something not too expensive, so you wait. And then, it depends on the category of the hotel. In this case, a hotel with three stars (three Spanish stars, so yeah!) And maybe not so well-located. I think that they take lots from other hotels that are already full, so they're reservations for the same day or two days before. But that's how they fill up in Spain: with last-minute tourists. It's the opposite of Paris, where you see hotels that are full until December, when you look at the three hotels in Barcelona, in October they're at zero percent. ...

Vassily: Do you not find that shocking, this idea of just dropping the prices at the last moment? As a client, for example.

Carine: Yes, of course. At the same time, from the hotelier's point of view, imagine that it's 3pm and you've still got 20 rooms to sell. You try anything. You drop the prices, because you've still got fairly significant fixed costs and you need to try and cover them. In fact, *I find that logic less shocking than the opposite*, because for me, *someone who reserves in advance really wants to go*: they absolutely want to go to this destination on those dates, etc. *Someone who buys at the last minute, either it's on a whim or it's an unforeseen event*. So, yeah, it's less expensive, but

it's not like they'd wanted to go absolutely on that date and that time. So yeah, as a consumer, to me that seems fine. (Interview, 4 August 2014)¹⁰⁹

But the algorithm is not always a matter of morality; it is often a means and support of a particularly intense form of rhetorical work. Because the revenue of the start-up is so intrinsically linked to the users', or customers' opinion on the quality of the recommended price, it is vital that one gains their trust about the reliability of the algorithm. The revenue management system having become a commodity in its own right, one must be capable of explaining, if not the mathematical subtleties which it incorporates, at least the overall logic of the algorithm, reinforcing the results that fit in this interpretative norm and, on the contrary, alleviating those that deviate from it; how to contain, for example, the erratic variations in price recommendations so as to make correspond what is with what should be according to the user's way of thinking.

Finally, the strictly technical aspect of algorithms should not be neglected on account of being self-evident: one must not forget that revenue management consists in solving a complex mathematical problem that requires having available powerful computing capabilities and calling in advanced optimization and

¹⁰⁹ In the questionnaire carried out at PriceMatch, I wanted to get the perspective of members on two distinct pricing practices: known as 'early bird' and 'last minute'. More precisely, I asked the following questions: 'Do you find it normal to give a reduction in price to customers that book a long time in advance?' and 'Do you find it normal to give a reduction in price to customers that reserve at the last minute?' These are the results. There is consensus on 'early bird' pricing: everyone asked found this pricing method, which gives preferential prices to customers reserving a long time in advance, totally acceptable; one person out of the 34 didn't have an opinion on the question. According to respondents, 'early bird' pricing is moral because it respects a certain logic of exchange: the idea that the various constraints associated with this tariff (cancellation fees, etc.) compensate for the few euros that are saved. Actually, it is not exactly the same package or product that is being sold. The 'last minute' tariff gives preferential prices to customers reserving a few days before the arrival date. Although this practice was also largely supported by those asked, five of them (out of 34 people, so around 15 percent) expressed some reservations, and three said that they had 'no opinion'. Regarding this tariff, members of the start-up had more difficulty finding a compensation with which to justify it.

stochastic techniques. Now, finding the solution to such a problem is not an easy thing to do. One way to achieve this is to proceed by trial and error, by trying many configurations, which sometime implies making mistakes, until—although nothing is less certain—the ‘one best way’ dear to Frederick W. Taylor is found.¹¹⁰ The start-up is not much suited to this kind of innovation; quite the contrary, the permanent state of emergency that characterises it effects a dogged adaptation process of its technology. For instance, the fabrication out of whole cloth of price-elasticity values. This is but one example of these multiple arrangements with the realities of the market, which one is hard-pressed to know whether to ascribe to the realm of intent to deceive or to necessity, that defines algorithm implementation in the concrete case of the start-up.

At PriceMatch, engineers must pursue a twofold objective: how to continually improve the performance of the algorithm, but also how to constantly allow for the requests of hoteliers—through the intermediary of account management—toward potential fulfilment of them. ‘The improvements that were made [after the first version of the algorithm] are full of little optimisations, full of business rules that came out of it,’ says Léo. ‘But, once again, rather than improve the algorithm’s performance, we were thinking from the point of view of what the hotelier was expecting to see, because at some point you have to sell the product’ (Interview, 24 September 2014). This direction has nothing accidental about it; it is the product of a rational and documented deliberation process conducted by the members of the technical team involved. To realise this, one needs, for example, only to browse the internal document I have reproduced hereunder (see Table I.4.1), which shows the tension that exists between the rhetorical dimension (here illustrated by the ‘marketing value’) and the technical aspects of the algorithm.

¹¹⁰ Frederick W. Taylor, *The Principles of Scientific Management*, New York, NY and London: Harper & Brothers, 1911.

Proposed Enhancements	Marketing Value ^a	Technical Value ^b	Complexity /Time	Score ^c	Ranking
Decorrelate price recommendations for each room type—this means to have the number of rooms reserved for each room type; today recommendations are made based on the total number of rooms reserved	1	2	- ^d	-	-
Provide price recommendations for more than two room types	1.5	2	1.5	2	2
Provide price recommendations for more than 30 days in advance	1.5	2	1.5	2	2
Offer a price list to the hotelier based on the demand, long-term forecast and a record of the impact of each event on demand	3	2.5	1	4.5	1

Provide a map of the events that take place in the area around the hotel	1.5	1	3	-0.5	6
Take into account the online reputation—this means crawling booking.com to get the online reputation history, incorporating it as a variable in the regression model, and displaying it on the platform to the hotelier	3	1	3	1	4
Collect detailed bookings from the PMS with information on the nationality of guests to carry out further analyses (e.g. cross-checking nationality against events taking place in a country would help improve the algorithm)	1.5	1.5	3	0	5

Note—^(a) Is it a selling point?, ^(b) Does it improve the property performance?, ^(c) Marketing Value + Technical Value – Complexity, ^(d) This depends on the available data in a PMS. If it is not available then it can be rather complicated.

Table I.4.1. Plan for algorithm improvements, autumn 2012.

The algorithm thus presupposes the combination of quasi-antinomic realms: technical methods and variables that make it possible to calculate a price, wedded to the ability to contain it by successive rules of control, to regulate, transform, and exploit it according to a plan that is objectively rational even as it remains far remote from that of the science that crafted it. This contradiction, inherent in its logic, explains why sociologists have insisted so much on the performative¹¹¹ nature of algorithms. The performativity of economics can easily be confirmed here through both a ‘theory effect’ [*effet de théorie*]¹¹² and a performative effect in a more restrictive sense¹¹³: a theory effect, because the architects of the algorithm have been trained to the basics of economics and in particular microeconomics and have made use of this knowledge in a practical objective; but also a restrictive performative effect, because the economic theory is therefore incorporated in the algorithm, exempting the users of the platform have any knowledge of it.

*

At the end of this ethnographic journey—suddenly interrupted by the acquisition of the start-up in May 2015—, the work in the start-up reveals itself to be a sort of ‘politicised science,’ a rhetorical and eminently political activity, even as it might seem to involve only those methods and variables that, incorporated in the algorithms, appear neutral and technical. And the start-up emerges as the product of individual actions carried out more or less separately which, while loosely

¹¹¹ ‘Scientific theories, models and statements are not constative; they are performative, that is, actively engaged in the constitution of the reality that it describes.’ Michel Callon, ‘What does it mean to say that economics is performative?’, CSI working papers series, 5, 2006, p. 10 (quote).

¹¹² On the notion of theory effect, see Pierre Bourdieu ‘The Social Space and the Genesis of Groups,’ *Theory and Society*, 14 (6), 1985 [1984], p. 723-44; Marie-France Garcia-Parpet, « La construction sociale d'un marché parfait : le marché au cadran de Fontaines-en-Sologne », *Actes de la recherche en sciences sociales*, 65 (1), 1986, p. 2-13.

¹¹³ For a definition of restrictive performativity, see Philippe Steiner, ‘Gift-Giving or Market?’, *Journal of Cultural Economy*, 3 (2), 2010, p. 243-59.

defined and organised in projects, are nonetheless objectively coordinated through meanings that start-up members give to their actions and the importance that these actions gain by being incorporated in a larger system of meaning. These elements of an anthropology of value as ‘meaning of actions’¹¹⁴ bring to centre stage the notion of productive activity in this limiting case of activity that is carried out in a start-up business and call for a move beyond the long-established separations between value and values, ideal and material, our own actions and some ‘concrete totality’ (as Karl Marx would put it), by indicating how the two phrases of these enduring dichotomies are formed together and mutually supported, complement and buttress themselves but also undermine one another in the same momentum.

To venture the lessons of this inquiry, I propose that the formation of what one may call the *digital mode of production*—that is, a specific set of relations between surplus extraction and the creation of human beings, which defines the mechanics of value-creation in the start-up world—is founded on a twofold antinomy. The first stems from the fact that productive activity in start-ups seems situated at the boundary between ‘material’ reality and abstraction, a sort of empirically realised limiting case of value-creation, yet one that develops an exceptionally complex, technical product of bits and quantisation steps, whose production is performed in a purely pragmatic mode, due to more prosaic short-term financial pressures. Whence the second contradiction: innovative entrepreneurship is a tall order, no doubt among the most uncertain ventures as evidenced by the very high number of start-ups that fail, whose actual success—either being acquired or issuing an IPO—means essentially the death of a form of organisation where innovations could spring up.¹¹⁵ This means that one

¹¹⁴ David Graeber, *Toward an Anthropological Theory of Value: The False Coin of Our Own Dreams*, New York, NY: Palgrave, 2001.

¹¹⁵ Contrary to a widespread idea, innovation does not generally occur within the American internet giants that constitute Google, Apple, Facebook, Amazon, and Microsoft (GAFAM) but rather outside the latters, in start-ups that gravitate toward them and often end up being absorbed by them, as attested by the many examples reported by specialised medias of innovative companies founded by ex-employees of GAFAM. See, for an example of this sort of innovation detour, Valentina Palladino, ‘Google Acquires Smartwatch OS Startup

cannot undertake a sociology of the start-up ‘culture’ that have the wherewithal to capture and convey the hallmark of the so-called ‘new economy’, without immersing oneself in the organisation, in its initial phase. In other words, first-hand understanding of the rituals and beliefs displayed in organisations is here a necessary condition of an adequate knowledge of the object, since ‘it is value’, according to Graeber, ‘that bring universes into being’¹¹⁶

Finally, the start-up is not made up of a discrete sum of accounting assets, of resources that can be transferred by sale and technical methods that would exist aside from the organisational context in which they are implemented but of an confused system of rituals and symbolic practices that, being constantly produced and maintained in and through the very functioning of the start-up, exist only in a situation so to speak—this explains the many failures that follow start-up acquisitions: the specific assets that these organisations possess are totally embedded and, once they have been delocalised, devoid of utility in any other structure. The work in the start-up is a ‘productive activity,’ in the sense of Karl Marx¹¹⁷, that is, it is not simply a matter of technical activity but also of seemingly mundane activities that encode symbolic structures. It follows that the creation of a start-up and the production that it supports come down to a process of value-creation of things, such as an algorithm or an organisation, as well as human beings, a particular valorisation of economy in which ‘the genesis of norms’ takes place ‘simultaneously with the practice of professional activity’ ... ‘and the ever-relative effectiveness of the imposed norm.’¹¹⁸

Cronologics, Founded by Ex-Employees,’ *Ars Technica*, 13 December 2016 [online]. <https://arstechnica.com/gadgets/2016/12/google-acquires-smartwatch-os-startup-cronologics-founded-by-ex-employees/> [Last consulted on 2 March 2018]

¹¹⁶ David Graeber, ‘It Is Value that Brings Universes into Being,’ *HAU: Journal of Ethnographic Theory*, 3 (2), 2013, p. 219-43.

¹¹⁷ Karl Marx, *Capital: Critique of the Political Economy*, Vol. 2, London: Penguin, 1885.

¹¹⁸ François Vatin, ‘Valuation as Evaluating and Valorizing,’ *Valuation Studies*, 1 (1), 2013, p. 31-50, p. 46 (quote).

Part II

1. Introduction: Revenue Management Systems, the Rhetoric of Science and the Paradox of Performativity

‘Selling the right seats to the right customers at the right prices.’

—American Airlines, 1987¹

This is the statement used to describe and justify the function of revenue management systems, or yield management systems.² Formulated for the first time by American Airlines in its 1987 annual report, it can be found in many publications, either practitioner or academic, produced along with the development of these systems. Such a slogan articulates, often abstract, schematic representations of the market that a sociological approach may be in a position to dissect.

For more than thirty years, the service industry has implemented sophisticated technical frameworks for revenue and pricing management and these pricing technologies have given rise to an industry of consultants and software-solutions providers. In parallel with this, and at roughly the same pace, certain

¹ American Airlines Inc., *1987 Annual Report*, Dallas TX, 1987; Barry C. Smith, John F. Leimkuhler, and Ross M. Darrow, ‘Yield Management at American Airlines,’ *Interfaces*, 22 (1), 1992, p. 8-31, p. 8 (quote). This definition of revenue management has been taken up in the mainstream publication of Robert G. Cross, *Revenue Management: Hard-Core Tactics for Market Domination*, New York, NY: Broadway Books, 1997. For an academic example of the typical vocabulary used for the hotel industry, see Sheryl E. Kimes, ‘The basics of yield management,’ *Cornell Hotel and Restaurant Administration Quarterly*, 30 (3), 1989, p. 14-9.

² The term ‘yield’ is specific to the airline industry. It is referred to as a measure of average fare paid per mile, per passenger. At present, the preferred term is, more generally, ‘revenue management,’ when the technology, after having been elaborated in the airline industry, spreads to other economic sectors, such as the railway sector and hospitality, as we will see thereafter in this presentation. Preliminary analysis of occurrences of phrases, carried out by means of the Google Ngram Viewer, confirms prevalence, since the beginning of the 2000, of the term ‘revenue management,’ by comparison with that of ‘yield management’ or ‘dynamic pricing,’ to refer to this pricing technology.

normative discourses have emerged with regard to seat inventory control and pricing. The aim of this essay is to analyse an aspect of this intertwining between technical pricing tools, on the one hand, and theoretical arguments on price formation, on the other hand. Indeed revenue management, especially in its computerised version, is often understood as a real ‘scientific pricing’ (characterised by ‘rational thought’ in opposition to ‘guesswork’).³ It seems to me that a sociological research on the way this science of prices is ‘performed’, to use Michel Callon’s phrase,⁴ would allow us not only to better understand the social effects that characterise the production of prices (how economics plays a role in shaping the reality which it purports to describe?), but also to learn about the limits of the efficacy of performative gesture. In this essay, I have chosen to concentrate on the issue of economic representations, and in particular on what David Graeber calls the ‘paradox of performativity,’ at the expense of the process and variables involved in price formation, of which I will only provide here limited information.⁵

³ For a plea for scientific pricing, see E. Andrew Boyd, *The Future of Pricing: How Airline Ticket Pricing Has Inspired a Revolution*, New York, NY: Palgrave Macmillan, 2007.

⁴ Michel Callon, ‘Introduction: The Embeddedness of Economic Markets in Economics,’ in Michel Callon (ed.), *The Laws of the Markets*, Oxford: Blackwell, 1998, p. 1-57; Fabian Muniesa, « Un robot walrasien : cotation électronique et justesse de la découverte des prix », *Politix*, 13 (52), 2000, p. 121-54; Donald MacKenzie and Yuval Millo, ‘Constructing a Market, Performing Theory: The Historical Sociology of a Financial Derivatives Exchange,’ *American Journal of Sociology*, 109 (1), 2003, p. 107-45; Donald Mackenzie, *An Engine, Not a Camera: How Financial Models Shape Markets*, Cambridge, MA: MIT Press, 2006; Donald MacKenzie, Fabian Muniesa, and Lucia Siu (eds.), *Do Economists Make Markets? On the Performativity of Economics*, Princeton, NJ: Princeton University Press, 2007; Fabian Muniesa and Michel Callon, « La performativité des sciences économiques », in Philippe Steiner and François Vatin (eds.), *Traité de sociologie économique*, Paris: Presses Universitaires de France, 2009, p. 289-324.

⁵ On the issue of social construction of prices, see Mark J. Zbaracki, ‘Pricing Structure and Structuring Price,’ working paper, Philadelphia, PA: University of Pennsylvania, 2005; Olav Velthuis, *Talking Prices: The Symbolic Meanings of Prices on the Market of Contemporary Art*, Princeton, NJ: Princeton University Press, 2005; Sandrine Barrey, « Formation et calcul des prix : le travail de tarification dans la grande distribution »,

This paradox, whereby the actors who create and maintain markets cannot explicitly say that some abstractions of economic science can become true simply because people believe they are true, deserves indeed, in the case in point, our full attention.⁶

My research object is a maker, amongst others, of a revenue management system: PriceMatch is a French company, more precisely a start-up, specialised in pricing for hotels.⁷ I consider here revenue management system as ‘technology of the future’: a combination of ‘esoteric forms of knowledge’ and ‘pragmatic techniques,’ of which command is claimed by certain specialists, and that aims at

Sociologie du travail, 46 (2), 2006, p. 142-58. See also my own contribution to this debate on price setting practices in the hotel industry, Vassily Pigounidès, *The Work of Setting Prices in a Large Hotel Resort*, Master Thesis, Paris: Paris-Sorbonne University and Cachan: Ecole normale supérieure of Cachan, 2011.

⁶ David Graeber, ‘The Sword, the Sponge, and the Paradox of Performativity: Some Observations on Fate, Luck, Financial Chicanery, and the Limits of Human Knowledge,’ *Social Analysis*, 56 (1), 2012, p. 25-42. In spite of the merit of this idea, David Graeber’s contribution to the debate on performativity of economics went almost unnoticed. One exception is the Laura Bear’s study on Bengalese entrepreneurs, in which the paper is mentioned, however very timidly. Laura Bear, ‘Capitalist Divination: Populist Speculators and Technologies of Imagination on the Hooghly River,’ *Comparative Studies of South Asia, Africa and the Middle East*, 35 (3), 2015, p. 408-23.

⁷ This study is part of a larger inquiry, including semi-directed interviews with actors who have contributed to the dissemination of revenue management, as well as observations conducted in companies of the hotel industry which use this technology. In the case at hand here, the empirical material was collected between 2014 and 2015 by following, in their day-to-day work, the professionals involved directly or indirectly to the work of setting price (revenue managers or account managers, engineers, IT technicians, salespeople, and hotel managers). It consists essentially of field notes and transcriptions of semi-directed interviews conducted with people at different layers of the organisation. This material was completed by a series of internal documents related to the functioning of the revenue management system developed by the engineers of PriceMatch, and in particular by the founders of the start-up. See Appendix A.

predicting and influencing upcoming events.⁸ In the hotel industry, revenue managers (pricers), who work in independent properties or in hotel chains, receive price suggestions on electronic platforms (directly on their computer or through remote servers) and decide, on the basis of these recommendations, price levels of hotel rooms. In this labour division between man and machine, the algorithm is in charge of accurately predicting, on the basis of past bookings, the demand aimed at the hotel for a given room and date, and of determining a selling price which will maximise the revenue of the property. It executes a logical programme in which the rules for price determination are henceforth inscribed, which exempts the user to have in mind the economic theories that she should be applying. I propose to analyse the way in which these rules can be mobilised in a specific representation of price formation. At this point, I want to make it clear that the issue of economic representation offers a rhetoric, if not political, meaning: a particular understanding of price formation can become real simply because the actors who promote this understanding are capable of convincing most of us, but this economic representation can become effective if and only if these actors do not admit that this may be the case. It is precisely, I believe, this paradox that the neo-institutional sociologists try to express when they speak of the 'logic of confidence.'⁹

⁸ David Graeber, 'The Sword, the Sponge, and the Paradox of Performativity,' *art. cit.*, p. 39-40.

⁹ The institutionalisation of rational myths in organisations is necessarily surrounded by an aura of hypocrisy and deceit. It seems to me that this is precisely what John W. Meyer and Brian Rowan really mean when they state that: 'The more an organization's structure is derived from institutionalized myths, the more it maintains elaborate displays of confidence, satisfaction, and good faith, internally and externally.' In fact, another way to put it is that you cannot actually tell that you are the head of the 'rationalised myth' division in some company, even though this is exactly the kind of job you do in reality. John W. Meyer and Brian Rowan, 'Institutionalized Organizations: Formal Structure as Myth and Ceremony,' *American Journal of Sociology*, 83 (2), 1977, p. 340-63, p. 358 (quote).

The anthropologists often use the concept of ‘performativity’ to describe the expressive performances of magicians in the so-called ‘primitive’ societies.¹⁰ The question, for them, is to determine and to define the type of rationality that gives to magic its efficacy while it does not provide any predictions, and to know how we can drift from magical rationality to critical and scientific rationality. But the problem becomes slightly more complicated when we introduce the possibility of scepticism in relation to magic.¹¹ Many pages have been written in anthropology about the ambivalence of magical beliefs which can exist within the very communities in which these beliefs take root. These debates on magic tend to circumvent the issue of scepticism: if the vast majority of witchdoctors are ‘frauds,’ a handful of them are seen as ‘reliable practitioners,’ and thus the problem of trickery is of no relevance. Quite the opposite, and following Graeber, I consider that scepticism, precisely, is what is interesting here. Hence, I have encountered, during my investigation, a hesitation as for the attitude to adopt vis-à-vis revenue management solutions: a technology that impresses by the complexity of the mathematical formulae and the scale of the database used or a mere ‘theory effect’

¹⁰ Stanley Tambiah, *Culture, Thought and Social Action: An Anthropological Perspective*, Cambridge: Cambridge University Press, 1985; David Graeber, *Toward an Anthropological Theory of Value: The False Coin of Our Own Dreams*, New York, NY: Palgrave, 2001, p. 240-47.

¹¹ The argument of scepticism can be found, for example, in the study of Edward E. Evans-Pritchard on Zande diviners in Soudan. So he writes: ‘Scepticism is included in the pattern of belief in witchdoctors. Faith and scepticism are alike traditional. Scepticism explains failures of witchdoctors, and being directed towards particular witchdoctors even tends to support faith in others.’ Rituals specialists also adopt a rather ambivalent position towards their own practice, as evidenced by the initiation of Kamanga, a Zande witchdoctor, related by Evans-Pritchard, or the experience of Quesalid, a Kwakiutl shaman, related by Franz Boas and Claude Lévi-Strauss. See Edward E. Evans-Pritchard, *Witchcraft, Oracles and Magic among the Azande*, Oxford: Oxford University Press, 1937, p. 193 (quote); Franz Boas, *Kwakiutl Ethnography*, Chicago, IL: University of Chicago Press, 1966; Claude Lévi-Strauss, « Le sorcier et sa magie », *Les Temps Modernes*, 41, 1949, p. 385-406.

(as Pierre Bourdieu would put it¹²) and, in which case, revenue management appears as a sort of scam, but whose consequences are no less real and significant.¹³

I will address this issue in three stages. I will begin with a description of the circumstances, both political (the 1978 Airline Deregulation Act) and technological (the advent of new information technologies), which have enabled the emergence of revenue management systems in the passenger air transport sector in the United States. In particular, I will focus on the revenue management system at American Airlines. We will see how the airline successfully established itself as a leading actor on the nascent market for revenue and pricing management technologies. I will present some of the properties of the DINAMO (Dynamic Inventory Allocation and Maintenance Optimizer) system—a system that I will then compare to its railway version as it was developed at the SNCF,¹⁴ the SOCRATE (*Système offrant à la clientèle des réservations d'affaires et de tourisme en Europe*) system. Thus we will see how the concept of optimality becomes one of the key arguments for the development and implementation of these pricing systems.

Next, I will give further details on the issue of economic representations involved in this kind of pricing technology. To this end, I will analyse, through a digression on scientific literature, the vocabulary specific to the seat inventory control problem, which can be found in academic texts that have sought to promote the automation of price determination. These texts contain the neoclassical

¹² Pierre Bourdieu, 'The Social Space and the Genesis of Groups,' *Theory and Society*, 14 (6), 1985 [1984], p. 723-44. For a practical application of the concept of theory effect, see Marie-France Garcia, « La construction sociale d'un marché parfait : le marché au cadran de Fontaines-en-Sologne », *Actes de la recherche en sciences sociales*, 65, 1986, p. 2-13.

¹³ This is what W. I. Thomas and Dorothy Swaine Thomas have already stated in their well-known 'theorem': 'If men define situations as real, they are real in their consequences.' Quoted by Robert K. Merton in Robert K. Merton, 'The Thomas Theorem and the Matthew Effect,' *Social Forces*, 74 (2), 1995, p. 379-424, p. 380 (quote).

¹⁴ *Société nationale des chemins de fer français*.

intuitions, à la Jules Dupuit,¹⁵ of the microeconomic theory of the monopoly—a theory, which conclusion is to discriminate among consumers by charging different prices according to the value each individual place on each good. We will see how, in this literature, a separation between ‘heuristics’ and ‘optimal models’ surfaces. In particular, we will observe the rhetorical operations involved in the academic substantiation of these models.

Finally, in a last section, I will return to the techniques of revenue management and describe a practical situation where such a device was put in place. I will describe the development of an online revenue management platform, commercialised in the mid-2010s by PriceMatch, a French start-up specialising in hotel pricing. We will see how this specific innovation articulates the notion of optimality and certain economic arguments in order to ‘perform’ a price—in this case a price suggestion. This pricing tool was devised with the purpose of convincing the users that the prices thus calculated are technically and scientifically sound. We will see how this practical case can illustrate the paradox of performativity that I have defined above.

The Sociology of Price Formation

This research has unfolded from its outset in the context of a scientific movement of renewal of the issue of price formation. For two decades, empirical sociological studies have addressed the object of prices specifically, contributing to the emergence of a research space where inquiries on the social construction of actors’ preferences and others focusing on various devices that shape and produce prices on the markets stand alongside.¹⁶ How does the structure of relations affect the

¹⁵ Jules Dupuit (1804-1866) was a French economist-engineer of the Ecole Nationale des Ponts et Chaussées (ENPC), whose work has formed the basis for the contemporary microeconomic theory and has proposed a formalisation of the welfare economics. See Robert B. Ekelund Jr. and Robert F. Hébert, *Secret Origins of Modern Microeconomics: Dupuit and the Engineers*, Chicago, IL: University of Chicago Press, 1999.

¹⁶ For a review on this nascent sociology of price formation, see Jens Beckert, ‘Where Do Prices Come From? Sociological Approaches to Price Formation,’ MPIfG Discussion Paper 11/3, Max Planck Institute for the Study of Societies, Cologne, March 2011.

price of legal services in large law firms or the stock-market value of American firms? How do devices (either legal, cognitive, organisational, or material) contribute to making prices on the American market for electricity, on the derivatives market in Chicago or at the Paris Bourse, and what is the key to success in pricing innovation? How should a price be established in situations where uncertainty on quality exists as is the case of the market for academics, the market of contemporary art, or that of Burgundy wine? How to set a price where there is none, or how much is the cost of oil slicks? How is the work of price-setting carried out in large retailers or in machine maintenance firms?¹⁷ The dynamism of research on this subject, which this enumeration of questions suggests, is evidence of the construction for several years of an *economic sociology of prices*.

¹⁷ Brian Uzzi and Ryon Lancaster, 'Embeddedness and Price Formation in the Corporate Law Market,' *American Sociological Review*, 69, 2004, p. 319-44; Ezra W. Zuckerman, 'Structural Incoherence and Stock Market Activity,' *American Sociological Review*, 69 (3), 2004, p. 405-32; Valery Yakubovich, Mark Granovetter, and Patrick McGuire, 'Electric Charges: The Social Construction of Rate Systems,' *Theory and Society*, 34, 2005, p. 579-612; Donald MacKenzie and Yuval Millo, 'Constructing a Market, Performing Theory: The Historical Sociology of a Financial Derivatives Exchange,' *American Journal of Sociology*, 109, 2003, p. 107-45; Fabian Muniesa, « Un robot walrasien. Cotation électronique et justesse de la découverte des prix », *Politix*, 13 (52), 2000, p. 121-54; Christine Musselin, *The market for academics. Studies in higher education*, New York, NY and Abingdon: Routledge, 2010 [2005]; Olav Velthuis, *Talking Prices: The Symbolic Meanings of Prices on the Market of Contemporary Art*, Princeton, NJ: Princeton University Press, 2005; Yuna Chiffoleau and Catherine Laporte, « La formation des prix : Le marché des vins en Bourgogne », *Revue Française de sociologie*, 45 (4), 2004, p. 653-80; Marion Fourcade, 'Price and Prejudice: On Economics, and the Enchantment/Disenchantment of Nature,' in Jens Beckert and Patrik Aspers (eds.), *The Worth of Goods: Valuation and Pricing in the Economy*, Oxford: Oxford University Press, 2011; Sandrine Barrey, « Formation et calcul des prix : le travail de tarification dans la grande distribution », *Sociologie du travail*, 46 (2), 2006, p. 142-58; Mark J. Zbaracki, 'Pricing Structure and Structuring Price,' working paper, Philadelphia, PA: University of Pennsylvania, 2005.

My exploration of revenue management thus draws from this field of sociology, by unfolding some of the unifying concerns on pricing technologies and price-setting work in organisations.

The contemporary renewal of economic sociology, generally attributed to Mark Granovetter and *New Economic Sociology* (NES), has been talked about a lot in sociological literature, notably for having put an end to decades of mutism of sociology with regard to economics.¹⁸ A similar trajectory can also be noted for the sociology of pricing, albeit a little later. For example, there was no entry for ‘pricing’ in the index of the second edition of the famous *Handbook of Economic Sociology*, edited by Neil J. Smelser et Richard Swedberg and published in 2005.¹⁹

In the NSE line of analysis, a host of works about prices have attempted to uncover the ways in which pricing practices are inscribed in complex sociability networks.²⁰ They bring into the fore the game of social mediation that underlies pricing. The processes and the variables at play when determining prices are here linked to their implication in social rather than commercial institutions. The irreconcilable connection between actor and network is constitutive of the non-economic mediations and motives that structure the adjustment of supply and demand, with the expression of relational behaviours distanced from short-term opportunist strategies (trust, reciprocity, etc.)

¹⁸ Bernard Convert and Johan Heilbron, ‘Where did the new economic sociology come from?’, *Theory and Society*, 36 (1), 2007, p. 31-54.

¹⁹ Neil J. Smelser and Richard Swedberg (eds.), *The Handbook of Economic Sociology*, 2^e ed., New York NY and Princeton, NJ: Russell Sage Foundation and Princeton University Press, 2005. At the letter ‘p’ however, we find reference to the work by Viviana A. Zelizer, *Pricing the Priceless Child*. Viviana A. Zelizer, *Pricing the Priceless Child*, New York, NY: Basic Books, 1985.

²⁰ Among the most notable contributions to this research current are Wayne Baker, ‘The Social Structure of a National Securities Market,’ *American Journal of Sociology*, 89 (4), 1984, p. 775-811; Joel Podolny, ‘A Status-based Model of Market Competition,’ *American Journal of Sociology*, 98, 1993, p. 829-72; Beth A. Benjamin and Joel Podolny, ‘Status, quality, and social order in the California Wine Industry,’ *Administrative Science Quarterly*, 44, 1999, p. 543-69; Brian Uzzi and Ryon Lancaster, ‘Embeddedness and Price Formation,’ *art. cit.*; Ezra W. Zuckerman, ‘Structural Incoherence and Stock Market Activity,’ *art. cit.*

The sociological variations around pricing determinants (network, status, etc.,) are more diversified than the quasi-systematic resort to regression would have us think. An example is the study by Robert G. Eccles and Harrison C. White on the price determination for transporting goods in American heavy-industry companies. The study essentially focusses on the the approach of the organisation as a space of mutually restricting competitive economic positions and interfaces.²¹ More recently, there is the study by Valery Yakubovich, Mark Granovetter and Patrick McGuire on the history of electricity pricing in the USA, which insists on the central position of networks of power relations in which actors are embedded, as well as economic theory (non-linear pricing) and measuring instruments (meters) in the social construction of this market and of prices.²² This essay takes this same path of historical sociology, mindful of heterogeneous and institutional processes of production of a given market. In it we will see the central role of sciences and techniques, but also of governments, in the production of successive pricing regimes establishing price as a social consequence.²³

A second branch is brought about by comparing thinking on the question of the coordination, interaction and matching of supply and demand on the markets, which sociologists approach through the fundamental notion of *goods*

²¹ Robert G. Eccles and Harrison C. White, 'Price and Authority in Inter-Profit Center Transactions,' *American Journal of Sociology*, 94, 1988, p. 17-51; Robert G. Eccles, *The Transfer Pricing Problem: A Theory for Practice*, New York, NY: Lexington Books, 1985.

²² Valery Yakubovich, Mark Granovetter, and Patrick McGuire, 'Electric Charges,' *art. cit.*

²³ In the same vein, the following passage is from *Economy and Society*, and is often cited in sociological studies on pricing: 'Money prices are the product of conflicts of interest and of compromises; they thus result from power constellations. Money is not a mere 'voucher for unspecified utilities,' which could be altered at will without any fundamental effect on the character of the price system as a struggle of man against man. 'Money' is, rather, primarily a weapon in this struggle, and prices are expressions of the struggle; they are instruments of calculation only as estimated quantifications of relative chances in this struggle of interests.' Max Weber, *Economy and Society*, Totowa, NJ: Bedminster Press, 1968[1921], p. 107-8.

qualification.²⁴ The sociological approach of prices becomes that of space, contentious and in competition, of diversified and combined equipment directed to allow the determination of a price.

The various works in this general direction are run through with questions linking them together.²⁵ The question of coordination involves taking into account the apparatus, objects, arrangements and more widely the whole group of human and non-human intermediaries to which are delegated all or part of the responsibility for price determination. Pricing in the space of the market is essentially the result of a distributed activity. What's more, analysing the procedure by which prices are calculated involves the social operations procedure of bringing up to standard—or profit-sharing, if you prefer—of actors, of spaces and of objects in a continuous process of construction of the supply and demand, and of definition of the properties of goods, or qualification.

This shared system of analysis does not exclude there being major divisions between actors, particularly concerning the fundamental question of the relation between sociological theory and economic theory. In the material approach

²⁴ See, Christine Musselin and Catherine Paradeise (eds.), *Quality: A Debate*, Amy Jacobs (trans.), *Sociologie du travail*, 47 (1), 2005, p. e89-e123.

²⁵ For empirical work in sociology that links pricing and qualification of goods, see, for example, Fabian Muniesa, *Des marchés comme algorithmes: sociologie de la cotation électronique à la Bourse de Paris*, PhD Thesis, Paris: Ecole des Mines de Paris, 2003; Donald Mackenzie and Yuval Millo, 'Constructing a Market, Performing Theory,' *art. cit.*; Yuna Chiffoleau and Catherine Laporte, « La formation des prix », *art. cit.*; Christine Musselin, *The market for academics*, *op. cit.*; Sandrine Barrey, « Formation et calcul des prix », *art. cit.*; Lucien Karpik, *Valuing the Unique: The Economics of Singularities*, Nora Scott (trans.), Princeton, NJ : Princeton University Press, 2010 [2007]; Koray Çalışkan, 'Price as a Market Device: Cotton Trading in Izmir Mercantile Exchange,' in Michel Callon, Yuval Millo, and Fabian Muniesa (eds.), *Market Devices*, London: Blackwell Publishing, 2007, p. 241-60; Catherine Grandclément, *Vendre sans vendeurs : sociologie des dispositifs d'achalandage en supermarché*, PhD Thesis, Paris: Ecole des Mines de Paris, 2008; Luc Boltanski and Arnaud Esquerre, « La "collection", une forme neuve du capitalisme la mise en valeur économique du passé et ses effets », *Les Temps Modernes*, 679 (3), 2014, p. 5-72.

to the market proposed by Michel Callon, the performativity of the economy²⁶ operates by training economic agents and more importantly through the proliferation of tools and measures for calculating that are produced by such technosciences of the economy as marketing, management or accounting.²⁷ The price is considered as “a quality just like any other quality”, that is transformed and tested bit by bit whilst the process of qualification is going on, which also contributes to its form.²⁸ Conversely, Lucien Karpik maintains a major division between two grammars (or economies) of coordination, with homogenous goods markets on one side (calculated and coordinated by price), and unique goods markets (judged and coordinated by qualities) on the other.²⁹

We will close this brief overview of the scientific developments from which this research grows, by evoking a third branch, that of the anthropology of prices in non-Western societies. A few years after the very rich reflections shared in *Marginal Gains*,³⁰ it is to Jane I. Guyer that we owe the beginnings of an ethnographic program on monetisation and price formation in contemporary societies.³¹ Its starting point is the historical observation that there is today on

²⁶ Michel Callon (ed.), *The Laws of the Markets*, London: Blackwell, 1998.

²⁷ Michel Callon and Fabian Muniesa, ‘Economic Markets as Calculative Collective Devices,’ *Organization Studies*, 26 (8), 2003, p. 1229-50; Franck Cochoy, *Une sociologie du packaging, ou l’âne de Buridan face au marché*, Paris: Presses universitaires de France, 2002; Anthony G. Hopwood and Peter Miller, *Accounting as Social and Institutional Practice*, Cambridge: Cambridge University Press, 1994.

²⁸ Michel Callon, « Postface : La formulation marchande des biens », in François Vatin, *Evaluer et valoriser : une sociologie économique de la mesure*, Toulouse: Presses Universitaires du Mirail, 2009, p. 247-69, p. 254 (quote).

²⁹ Lucien Karpik, *Valuing the Unique*, *op. cit.*;

³⁰ Jane I. Guyer, *Marginal Gains. Monetary Transactions in Atlantic Africa*, Chicago, IL and London: University of Chicago Press, 2004.

³¹ Jane I. Guyer, ‘Composites, Fictions and Risk: Toward an Ethnography of Price,’ in Chris Hann and Keith Hart (eds.), *Market and Society: The Great Transformation Today*, Cambridge: Cambridge University Press, 2009, p. 203-20.

increasingly open recognition that “prices are composites across the board.”³² Consumers are trained by prices of plane tickets, for example, to know about added taxes, fees, and payments, which are often now itemised. For example, British Airways online booking service gives a flight price, and then adds: an online booking fee; a share of taxes and fees demanded by governments, authorities, or airport owners; an insurance and security surcharge (since 9/11); and a fuel surcharge. We are actually reminded that all prices are fictions—literally results of narratives of creation, addition, and subtraction. From a theoretical perspective, the result is a *moral economy*³³ of *transparently composite prices*, which nevertheless retain the mystery of their components. The aim is, in line with the work of Karl Polanyi,³⁴ to apprehend the classical factors (land, labour, capital, state) and more diffuse and difficult to identify components (risk, risk-mitigation instruments) that are incorporated into price.

From this theoretical background, price ethnography compels the capitalisation of a series of empirical case studies of concrete markets,³⁵ thereby joining a certain section of contemporary economic sociology of prices.³⁶ Price ethnography engages in the tradition of on-the-ground and localised observations

³² Jane I. Guyer, *ibid.*, p. 204.

³³ Edward P. Thompson, ‘The moral economy of the English crowd in the eighteenth century,’ *Past & Present*, 50, 1971, p. 76-136.

³⁴ Karl Polanyi, *The Great Transformation: The Political and Economic Origins of Our Time*, Boston, MA: Beacon Press, 2001 [1944].

³⁵ In addition to the work of Jane I. Guyer, I have to mention, for example, Paul Alexander’s series of articles on Java: Jennifer Alexander and Paul Alexander, ‘What’s a Fair Price? Price-Setting and Trading Partnerships in Javanese Markets,’ *Man*, 26 (3), 1991, p. 493-512; Paul Alexander, ‘What’s in a price? Trading Practices in Peasant (and other) Markets,’ in Roy Dilley (ed.), *Contesting Markets. Analyses of Ideology, Discourse and Practice*, Edinburgh: Edinburgh University Press, 1992, p. 79-96.

³⁶ Here I think of the sociological studies respectively conducted by Sandrine Barrey on large retailers, of Mark J. Zbaracki on manufactured parts, or that of Olav Velthuis on the contemporary art market. Sandrine Barrey, « Formation et calcul des prix », *art. cit.*; Mark J. Zbaracki, ‘Pricing Structure and Structuring Price,’ *art. cit.*; Olav Velthuis, *Talking Prices*, *op. cit.*.

so that it can use a reflexive empiricism that describes and gives voice to professional practices and indigenous theories at work in price determination, as well as the way in which prices are produced by the socio-technical organisation or by all actors in a market or in a given organisation.

2. Revenue Management at American Airlines: Electronic Pricing Systems, the 1978 Airline Deregulation Act, and the Making of an Industry

The Deregulation of American Skies

For a long time, a one-fare system was the traditional form of pricing in the airline industry. Fares remained broadly steady: each route and origin-destination was offered to the market by a given airline at a price set by the regulator. Bookings from passengers were carried out by phone or mail or through the intervention of travel agencies and were entered in the reservations systems on a space-available basis. Although at first the booking process could be very costly and time-consuming, airlines had rapidly adopted computerized systems to store and retrieve information and efficiently process bookings since as long ago as the 1960s. Thus, with the advent of computerised reservations systems, the airline industry became the first industry to be fully equipped with computers.³⁷ At the time of booking, operators were able to track virtually in real time the remaining capacity for each flight operated by the airline, and steer customers to a given direct or transit flight at a specific time and date of departure. If applicable, the reservations systems also enabled operators to edit or cancel bookings. Some fare adjustments were soon undertaken by airlines for a number of flights in international markets.³⁸

³⁷ On the history of reservations and distribution systems in the airline industry, see Duncan C. Copeland, Richard O. Mason, and James L. McKenney, 'Sabre: The development of information-based competence and execution of information-based competition,' *IEEE Annals of the History of Computing*, 17 (3), 1995, p. 30-57; Richard O. Mason and James L. McKenney, *Waves of Change: Business Evolution through Information Technology*, Cambridge MA, Harvard Business School Press, 1995; Duncan C. Copeland and James L. McKenney, 'Airline Reservations Systems: Lessons from History,' *MIS Quarterly*, 12 (3), 1988, p. 353-370; Jon Eklund, 'The Reservisor Automated Airline Reservation System: Combining Communications and Computing,' *IEEE Annals of the History of Computing*, 16 (1), 1994, p. 62-69.

³⁸ The introduction of advance purchase excursion (APEX) fares in international markets enabled any passenger, regardless of age or group affiliation, to purchase air travel at a reduced price. These fares required advance purchase of a round-trip ticket and a minimum

Nevertheless, in this regulated context, customers navigated their way through the range of offers based on service convenience, and fares, albeit high, played a relatively minor role.

Prior to deregulation in 1978, prices of plane tickets were subject to government control in the United States.³⁹ All domestic interstate routes were regulated by the Civil Aeronautics Board (CAB), setting fares but also routes, schedules as well as market entrance of a new airline. The market was governed by a handful of large carriers, the so-called ‘majors.’ They benefited from legal monopoly on given routes. Profits were virtually guaranteed: fares were set by the CAB such that they ensured a reasonable rate of return for the carriers (the board applied the simple following formula: costs + reasonable return on investment = revenue requirement).⁴⁰ Although increasing criticism arose over the excessive bureaucracy of the Board, even connivance between the Board and airlines, the trigger for authorities to act was the upheaval in the economic environment: the 1973 oil crisis, leading to a rapid increase in prices of plane tickets. Given that this was clearly in the public eye, the ‘democratisation of air travel’ became a matter of concern for the federal government. In 1977, President Jimmy Carter appointed Alfred E. Kahn, professor of Political Economy at Cornell University, to be the chair of the CAB and undertake the deregulation of the airline industry—a feat that

length of stay at the destination point. This type of fare spread to North American markets in 1975 when American Airlines introduced its first ‘super-saver’ fares. Peter P. Belobaba, *Air Travel Demand and Airline Seat Inventory Management*, Doctoral Thesis, Cambridge, Massachusetts Institute of Technology, Dept. of Aeronautics and Astronautics, 1987, p. 13. It is these moves in fare policy that led, in the early 1970s, Kenneth Littlewood and other operational researchers at British Airways to start developing models to control ‘early bird’ discounts. Kenneth Littlewood, ‘Forecasting and Control of Passenger Bookings,’ *Journal of Revenue and Pricing Management*, 4 (2), 2005 [1972], p. 111-23.

³⁹ Stephen Paul Dempsey and Andrew R. Goetz, *Airline Deregulation and Laissez-Faire Mythology*, Westport, CT: Greenwood Publishing Group, 1992.

⁴⁰ Stephen Paul Dempsey and Andrew R. Goetz, *ibid.*, p. 174. On the ‘full cost’ principle for price setting, see Robert L. Hall, and Charles J. Hitch, ‘Price Theory and Business Behaviour,’ *Oxford Economic Papers*, 2, 1939, p. 12-45.

earned him the title of the ‘Father of Airline Deregulation’. Contrary to 1938, when state intervention was meant to protect consumers from unbridled competition with a particular focus on security requirements, the purpose of the new bill, that was highly influenced by the neoliberal ideology of the time⁴¹, was to benefit the interest of consumers by advocating free and fair competition. The Airline Deregulation Act was passed on October 24, 1978. In particular it enabled airlines to set their fares and routes in utter freedom.⁴²

Revenue management, or yield management as it was often called at the time, emerged in the context of radical uncertainty elicited by airline deregulation.⁴³ The incumbents were rapidly faced with stiff competition from low-cost invaders creeping up everywhere.⁴⁴ With the load factor (the percentage of seats filled by paying passengers and a key to measuring profit) decreasing, the majors went on

⁴¹ David Harvey, *A Brief History of Neoliberalism*, Oxford: Oxford University Press, 2005.

⁴² It is noteworthy that, in Europe, no significant measure of deregulation was taken before the mid-1980s. The first step towards airline deregulation was British Airways’s privatisation in 1986. A spate of total or partial denationalisations of several airlines then followed: Alitalia, KLM, Lufthansa, Sabena. In 1987, the European Commission issued a directive to accentuate liberalisation of European skies. In particular, it gave companies relative freedom to set their fares within a given price range. In 1997, the European airline industry was fully opened to competition.

⁴³ This brief history of revenue management systems essentially rests on the following two books written by veterans of the post-deregulation period: Robert G. Cross, *Revenue Management*, *op. cit.*; E. Andrew Boyd, *The Future of Pricing*, *op. cit.*

⁴⁴ The terminology ‘incumbents versus invaders’ is borrowed from the economic sociology of Neil Fligstein. In his work, Fligstein has sought to highlight the stabilisation or re-stabilisation mechanisms of markets through which the actors will create or re-create stable worlds to avoid the devastating consequences of undue competition on prices. And it would certainly be of interest to look at the case of revenue management as a product of deregulation from the ‘conception of control’ perspective. See, for example, Neil Fligstein, *The Transformation of Corporate Control*, Cambridge, MA: Harvard University Press, 1990; and, Neil Fligstein, *The Architecture of Markets: An Economic Sociology of Twenty-first-century Capitalist Societies*, Princeton, NJ: Princeton University Press, 2001.

the offensive by cutting ticket prices. Yet, things did not improve: the load factor was up but yields (the amount of money the airline computes per passenger mile) were down, and revenues stagnated. With the low-fare airlines entering the market, the majors did not appeal anymore to a substantial price-sensitive segment of demand that slipped out of their control to the benefit of the low-cost companies. Even more serious was the threat of seeing their own clientele siphoned off by the invaders. The deflection came from the realisation that, although the low-cost companies had a permanent cost advantage, the additional seat sold on a given flight (or the marginal cost) was almost exactly zero both for major and low-cost airlines. This means the majors would have benefited from exhausting the remaining stock of empty seats at lower prices, while continuing to sell tickets at the same price to regular customers. The way to achieve this consisted in creating customer segmentation—typically ‘business’ and ‘leisure’ categories—and allocating a given number of priced seats for each of these segments.⁴⁵

Although other airlines were experimenting with similar ideas at the time, it is probably at American Airlines that the first technical solution to this problem was developed: the DINAMO (Dynamic Inventory Allocation and Maintenance Optimizer) system. In 1977, a limited number of low fares with restrictions for purchase—advanced purchase requirements, cancellation penalties, and so forth—were offered by the company. In 1988, when the revenue management system was implemented in full, all flights were subjected to an electronic control of the availability of these special fares. The development of this system, of which the key stages have been detailed in Smith, Leimkuhler and Darrow (1992),⁴⁶ articulates a series of arguments to justify this technical choice: the new system generates,

⁴⁵ On the other hand, to ‘recapture’ business customers, or if one prefers to make them loyal, most majors launched at the same time frequent flyer programmes. Thus, these companies could control the market demand at both ends. Frank Cochoy, « Les Sciences du social et leur demande : le cas du marketing », *Sciences de la Société*, 49, 2000, p. 47-61; Lucien Karpik, *Valuing the Unique: The Economics of Singularities*, Nora Scott (trans.), Princeton, NJ: Princeton University Press, 2010 [2007].

⁴⁶ Barry C. Smith, John F. Leimkuhler and Ross M. Darrow, ‘Yield Management at American Airlines,’ *art. cit.*

according to the authors, quantifiable benefits in incremental revenue, increase airlines' ability to survive price wars, and allows them to compete and succeed in an environment of stiff price competition.

American Airlines versus People Express

Many actors agree on the redoubtable capacity of revenue management systems and on the efficiency of their subversive action against competitors. Immediately after deregulation, many new airlines appeared, although most were small commuter lines. But even as early as the mid-1980s there had been a series of bankruptcies and mergers, and only a handful of large carriers remained.⁴⁷ Revenue management played a part in this turnaround—at least it did if you believe the managerial literature. Revenue management referred not only to a pricing technology for enhancing revenue and profit; when used by the majors, it was seen as a comprehensive strategy for bypassing competition to dominate the market, rather than being ruled by it.

This is best illustrated by the confrontation between American Airlines and People Express.⁴⁸ Founded in 1980, People Express was a low-cost company which had expanded very rapidly by offering prices up to 70 percent lower than those of the major airlines. In 1986, it had become the fifth largest airlines in the United States, with nearly 160 airports served, 1 million passengers transported every month, and an annual revenue above 1.2 billion euros. By bringing air transportation to the masses and by making money in doing it, People Express had essentially fulfilled the mission of the promoters of deregulation. So Alfred Kahn trumpeted in the Business column of the Time, dated 13 January 1986: 'People Express is clearly the archetypical deregulation success story and the most

⁴⁷ On the phenomenon of concentration following the deregulation of airlines in the United States, see Stephen Paul Dempsey, Andrew R. Goetz, *Airline Deregulation and Laissez-Faire Mythology*, *op. cit.*, p. 221-42.

⁴⁸ 'Case Study: The Attack of the Laser Fares,' in Robert G. Cross, *Revenue Management*, *op. cit.*, p. 99-130.

spectacular of my babies. It is the case that makes me the proudest.⁴⁹ Nevertheless, by the end of 1986, People Express was taken over by one of its competitors, after having suffered record losses of 345 million dollars during the year.

We were a vibrant, profitable company from 1981 to 1985, and then we tipped right over into losing \$50 million a month. We were still the same company. ... What changed was American's ability to do widespread yield management in every one of our markets. We had been profitable from the day we started until American came at us with Ultimate Super Savers [*the new pricing strategy introduced by American Airlines in 1984*]. That was the end of our run because they were able to underprice us at will, and surreptitiously.

Obviously People Express failed. ... We did a lot of things right. But we didn't get our hands around Yield Management and automation issues. ... [If I were to do it again,] the number one priority on my list every day would be to see that my people got the best information technology tools. In my view, that's what drives airline revenues today more than any other factor—more than service, more than planes, more than routes.⁵⁰

This is how Donald Burr, founder and ex-president of People Express, famously explained the reason for the demise of the company. For him, it was because of these sophisticated computer programmes, which allowed the large airlines such as American Airlines to manage yield to fill empty seats at People Express ticket

⁴⁹ Charles P. Alexander, 'Super Savings in the Skies,' *Time*, 127, January 13, 1986, at 40, 41 (Kahn quote). Six months later, when People Express was on the verge of bankruptcy, a reporter of the New York Times quoted Kahn as expressing a rather different view: 'United, American and other major, full service airlines' ... 'developed very sophisticated, computerized scheduling programs, which have enabled them to determine how many seats on each flight are likely to go unsold at normal fares but might be filled if they offer a steep discount.' ... 'Thus, it appears the People Express model of offering uniform, low fares with no restrictions cannot survive. And I am pessimistic about new companies being able to compete successfully by offering uniform low fares to everybody without discriminating among different travellers and without imposing such restrictions as advance purchase or cancellation penalties.' Steven Prokesch, 'People Express: A Case Study,' *New York Times*, July 6, 1986, at 3-1, col. 3.

⁵⁰ Robert G. Cross, *Revenue Management*, *op. cit.*, p. 125 and 129.

prices. Although this explanation has little basis in fact,⁵¹ it has been a mainstay of revenue management history textbooks for generations.

The ‘People Express versus American Airlines’ episode represents a sort of ‘mythological fight between Good and Evil.’⁵² His quasi-messianic mission to ‘democratise’ air travel by offering cheaper-than-driving tickets and his heterodox practices in management reminiscent of those of today’s digital start-ups had contributed to Donald Burr’s public image as a hero of the drama. Against him, Robert L. Crandall, then president of American’s parent, the AMR Corporation, had been cast in the role of the perfect villain. ‘His tough stance on union wages, his bare-knuckled price-cutting and his proclivity for salty phrases,’ as one journalist of the *New York Times* noted, added to a murky affair of price-fixing in 1982, had indeed earned him a sulphurous reputation.⁵³ One can easily see the moral effects that such an account can imply and how the revenue management systems are invested with a sort of diabolical efficacy in a story like this. Here is an example that, according to some actors, constituted a real scandal in the eyes of carriers: charging different prices to different people for the same service. At People Express, and at most of its competitors for this matter, a certain conception required that ‘in an attempt to be fair with all passengers,’ airlines had to offer ‘the same price to everybody on the plane’⁵⁴ (although almost all also applied peak and off-

⁵¹ Stephen P. Demsey and Andrew R. Goetz have critically assessed airline deregulation. In particular, they have pointed out that People Express’s primitive yield and capacity management system was but one of many reasons behind the company’s failure. Other factors include: a flagrant undercapitalisation, immoderate and hasty expansion, ‘cultlike corporate culture,’ inexperienced staff and chaotic management systems, and poor and undependable service. Stephen Paul Dempsey, Andrew R. Goetz, *Airline Deregulation and Laissez-Faire Mythology*, *op. cit.*, p. 92.

⁵² Roland Barthes, ‘The World of Wrestling,’ in *Mythologies*, Annette Lavers (trans.), New York, NY: Hill and Wang, 1972 [1957], p. 15-25, p. 23 (quote).

⁵³ Thomas C. Hayes, ‘American Joins the Low-Cost Ranks,’ *New York Times*, December 8, 1985, at 8F.

⁵⁴ Robert G. Cross, *Revenue Management*, *op. cit.*, p. 103.

peak fares at the time). With revenue management, ‘the \$1,000 passenger’ could be ‘sitting next to the \$100 passenger on the same airplane,’⁵⁵ which implies a quite different understanding of what is acceptable and what is not.⁵⁶ For all that it offers a gripping illustration of the efficacy of this pricing technology, it should also be noted the first days of revenue management systems are invariably told by people who have an objective interest in telling the story in these terms. They are professionals and other consultants working for or academics maintaining strong ties with the industry, in particular companies providing revenue and pricing software.

⁵⁵ Robert G. Cross, *ibid.*, p. 121-2.

⁵⁶ As in all such accounts, it is recognised, in spite of their fallibility, the moral capacities of the different actors involved in organisational decision-making, unlike for the passengers whose behaviours are reduced to mere consumption: ‘[The People Express’s managers] hoped that there would be backlash from the public. They mistakenly believed that the public would not tolerate variable prices on the same plane. “We kept saying that the customers won’t put up with this,” recalls Burr. “They will revolt. Americans not going to be able to do it.” ... “They just couldn’t believe that the \$1,000 passenger would tolerate sitting next to the \$100 passenger on the same airplane. They were wrong.’ Robert G. Cross, *ibid.*, p. 121-2.

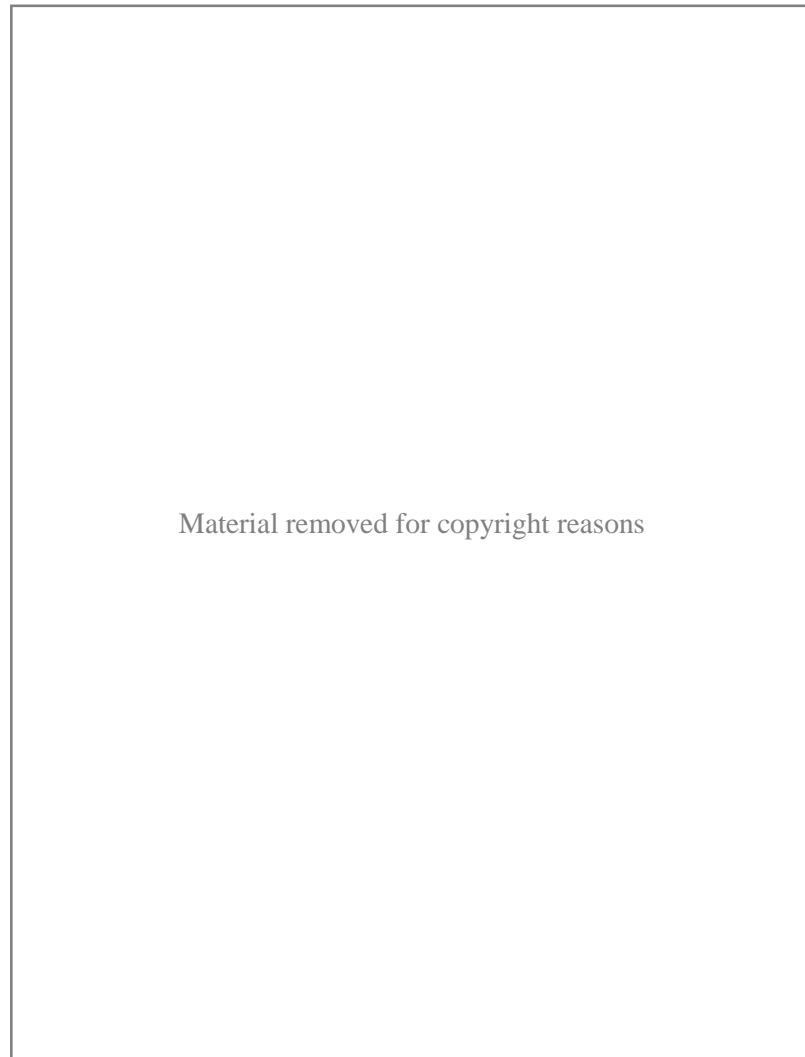


Figure II.1.1. People Express President, Donald Burr, was Time's cover on January 13, 1986.

Technologies of Pricing: The Making of an Industry

The technology of American Airlines has evolved since the 1980s, at the pace of institutional change. In 1988, AADT (American Airlines Decision Technologies) was formed with a clear commercial purpose: it was even considered from 1996 as a legal entity, whose activities were focused on developing, managing, promoting, and exporting its technology, and in particular its DINAMO system.⁵⁷ By the mid-1990s, AADT joined The SABRE Group and SABRE Development Services (which provided all applications development), AMR Information Services (which marketed SABRE and American Airlines legacy systems externally), SABRE Computer Services (which provided the data centre, communications network, and desktop support for American Airlines and the travel distribution business), and AADT merged into one organisation, which became known as SABRE Technology Solutions, creating a comprehensive information technology solutions division. DINAMO became a product per se, which could be marketed. It was exported to other airlines (contracts with, among others, Qantas Airways in Australia and Lufthansa in Germany) and versions were devised for other industries: for railways, such as Amtrak in the United States and SNCF in France, hotels, with Hyatt Hotels in the United States and Club Med in France, and cruise lines such as Royal Caribbean International in Norway. A market for revenue management systems emerged, characterised either by technological competition or strategic cooperation.⁵⁸

Pricing became, in this new environment, a strategic issue. It was a question of allowing much greater flexibility in offering a variety of products for sale, maintaining market share by offering low fares that stimulate additional traffic, limiting revenue dilution by restricting the availability of these fares on flights that

⁵⁷ Thomas M. Cook, 'SABRE soars,' *OR/MS Today*, 25 (3), 1998, p. 26-31; Peter Horner, 'The Sabre Story: the Making of OR Magic at AMR,' *OR/MS Today*, June 2000, p. 46-7.

⁵⁸ A good example of such cooperative efforts is the MIT/PODS Revenue Management Research Consortium (see later on in this essay). For a review of technical solutions that were available at the turn of the 1990s, see Sylvain Daudel and Georges Vialle, *Yield management: Applications to Air Transport and Other Service Industries*, Paris: Presses de l'Institut du Transport Aérien, 1994.

have substantial high-value demand, and, ultimately, enhancing revenue, and thus profits, by optimising the price and availability of products. These objectives were addressed through numerous technical innovations and adjustments, giving each system its own character.

In the following, I will not deal with all the many and varied technical elements devised to determine the optimal price in the case of the American Airlines' system: overbooking levels (to compensate for passenger cancellations and no-shows), virtual nesting (to cluster the market/fare classes into a small number of similarly valued groupings called buckets, reducing the inventory controls to a manageable number), booking valuation (to determine an effective revenue for each market/fare class based on the fare and the probability that a connecting passenger will displace local traffic on each segment of the routing; default indexing to optimally determine the default table items), passenger preferences modelling (to estimate a passenger utility function), demand forecast monitoring (to flag biased forecast), critical flight identification (to identify flights requiring manual review, either because the input data are in error or because of special circumstances, such as a major sporting event or public holiday), index monitoring (to report on virtual nesting and to flag market/fare classes that should be re-indexed), revenue opportunity modelling (to measure overall yield-management performance), etc. Instead, I have chosen to focus on one particular aspect of the revenue management system, namely: the very mechanism governing the search for the *right price*, the process of determining the number of discount fares to offer on a flight.⁵⁹

Adjusting Seat Inventory and Prices: Ascendant or Unrestricted

To find the price that maximises revenue, American Airlines' algorithm was required to solve two separate problems: that of determining the number of discount fares to offer on a flight; and that of controlling the availability of these discount fares. With only two fares available—full and discount—and when discount fares

⁵⁹ Barry C. Smith, John F. Leimkuhler, Ross M. Darrow, 'Yield Management at American Airlines,' *op. cit.*, p. 13-6.

are first offered,⁶⁰ the solution of the first problem is simple: the decision to accept or reject the next (or marginal) request for a discount seat determines the number of discount fares offered for sale. If the company accepts a discount request, the revenue it earns is the discount fare. If it rejects the discount request, two outcomes are possible: it may result either in an additional empty seat and no additional revenue or in a sale of the remaining seat to a full-fare passenger. In other words, the decision to accept or reject a discount request depends on the probability p of getting the full fare when a discount is rejected, a probability which is determined by several factors including the number of remaining available seats and the distribution of demand. The algorithm compared the value of p to the ratio of the discount fare to the full fare: a discount seat request was rejected if $(p) (\$full\ fare) > (\$discount\ fare)$. This algorithmic expression is known as ‘Littlewood’s rule’.⁶¹

Although it becomes more complicated, the problem of determining discount allocation for more than two fare classes is similar. American’s approach was still to weigh the marginal value of a fare request against the marginal value of all other fares. It considers the same variables discussed above, but includes the

⁶⁰ It is indeed a general idea in the airline industry that the low-revenue passengers tend to book earlier than high-revenue passengers. This idea—which, as I have noted first-hand, is not self-evident—is assumed in the algorithm.

⁶¹ Kenneth Littlewood, ‘Forecasting and Control of Passenger Bookings,’ *art. cit.*, p. 118-21.

values for each fare type.⁶² This problem is formulated in the literature as a dynamic programme.⁶³

Once the number of discount fares had been determined, the algorithm was required to solve the second problem: the control of the availability for each discount class through a process known as nesting. Nesting is used to make subsets of the seats available to various levels of discount, where each nested fare class is a subset of the next higher fare class. Indeed, if the fare classes are controlled independently, it would be possible to sell a low-revenue booking and simultaneously turn away a high-revenue passenger. In this process of discount allocation, the algorithm observes a fundamental priority: ensuring that a low-value seat is never available when a higher-valued fare is closed. This means that forecasting too much demand in a higher-revenue class causes poor discount allocation only for lower-revenue classes. If all of the high-value demand does not occur, a second priority can intervene: minimising the number of empty seats on a given flight (bookings protected for high-value customers can be made available to lower-value customers). Other ancillary priorities can come into play if ever, for example, the company faces a large number of cancellations.

Because future expected demand depends on the length of time until departure, the discount allocation decision is updated at regular intervals. Yet, it is likely that a fare that has been closed to additional sales may need to be reopened

⁶² A separate marginal expected revenue function existed for each fare class. (These functions were shaped as logistic curves, which means that the incremental revenue from one additional seat decreases as the number of reservations offered increases.) The point at which the marginal value of the full fare is equal to the marginal value of the moderately discounted fare is the optimal number of reservations to protect for full-fare passengers and withhold from any discount passengers. If there are three fare-types only (full, moderate discount, and deep discount), then the point at which the marginal value of the marginal value of the moderately discounted fare is equal to the marginal value of the deeply discounted fare represents the total number of reservations to allocate to full-fare and moderate-discount passengers and withhold from sale to deep-discount passengers.

⁶³ Kalyan T. Talluri, Garrett J. van Ryzin, *The Theory and Practice of Revenue Management*, Berlin: Springer Science + Business Media, 2004, p. 36-7.

due to a sudden change in demand: a price decrease would follow a price increase (and so forth). The algorithm then needs to solve a problem of fairness. Indeed, I have identified two possibilities that seem to bring into opposition two different ideas of fairness. One of the differences between the DINAMO system and its railway version, the SOCRATE (*Système offrant à la clientèle des réservations d'affaires et de tourisme en Europe*) system, as it was implemented at the SNCF in France,⁶⁴ is precisely the logic of this algorithm for discount seat allocation.

The SNCF's system applies the principle of 'ascendant revenue management': the amount of time before departure then plays a crucial role and the bookings are sold in strict order of revenue generated by each fare class (the lower-valued discount classes are closed first, and cannot be reopened). The same did not apply for the DINAMO system, of which the discount allocation algorithm could be rather described as 'unrestricted revenue management': the fare classes could be closed and reopened at will, and in any order, independently of the length of time before departure. The system allowed, for example, the possibility of making deep-discount seats available for sale a few days before departure to sell off the remaining seats on a flight. The ascendant revenue management at the SNCF was programmed in this way, according to people in charge, for 'political reasons': the aim was to maintain a certain coherence between the marketing communication actions and the group's pricing strategy. The often abstruse and confusing nature of the new revenue management strategy allowed a deviation from the self-imposed rule

⁶⁴ Jean Finez, « La construction des prix à la SNCF, une socio-histoire de la tarification. De la péréquation au yield management (1938-2012) », *Revue française de sociologie*, 55 (1), 2014, p. 5-39. See also, Gilles Dumont, *Innovation organisationnelle et résistance au changement : l'introduction du système Socrate à la SNCF*, Master Thesis in Administrative Sciences, Paris, Université Panthéon-Assas—Paris II, 1996; Nathalie N. Mitev, 'The globalisation of transport? Computerised reservation systems at American Airlines and French Railways,' in Peter Lyth and Helmuth Trischler (eds.), *Wiring Prometheus: Globalisation, History and Technology*, Aarhus: Aarhus University Press, 2004, p. 187-210; Nathalie N. Mitev, 'Trains, planes and computers: from high-speed trains to computerised reservation systems at French railways,' *Journal of transport history*, 25 (2), 2004, p.101-23.

whereby the fairness of pricing is achieved by the direction of price changes: ‘The earlier you book, the more you save,’⁶⁵ the advertisements said. The new system had been subject, since its full implementation in 1993, to criticism by the public, politicians, and in the press. This culminated in an information report submitted to the French parliament in 2008, which enjoined the national railway to clarify its pricing policy.⁶⁶ It was around this time that the ‘the earlier the cheaper’ rule was incorporated in the SNCF’s algorithm. ‘It is a commitment; incidentally the computer system is programmed to block any low-fare re-openings,’ assured the director of the SNCF’s revenue management department to the reporters of *Le Monde* in April 2011.⁶⁷ Moreover, the absence of restrictions in the movement of prices acted as an incentive for customers to postpone their purchases until the last moment of the booking period, with the adverse consequences which this entails in terms of demand forecasting (lack of visibility) and discount control (high volatility).

It is easy to recognise, beyond the mere function, the moral effects that a technical device can imply by what it authorises. It is clear, for example, how certain practices in price setting have ceased to exist in an environment such as the SNCF. Here is an example that, according to some actors, marked the transition in the minds of revenue management analysts: ‘going back’ was no longer possible after a fare class had been closed. With the DINAMO system, due to the absence of limitations in price changes, if a mistake had been made (too many seats had been protected for higher-valued fare classes), there was nothing that could prevent

⁶⁵ SNCF, « SNCF découverte : rêve Prem’s », Partizan Midi Minuit, 19 May 2003 [online]. <http://www.ina.fr/video/PUB2416360067/sncf-decouverte-reve-prem-s-video.html> [consulted on 5 May 2017]

⁶⁶ Assemblée Nationale, 2008, *Rapport d’information sur la politique tarifaire de la SNCF*, 1161, Hervé Mariton, Paris, Assemblée Nationale, 15 October 2008.

⁶⁷ Jean-Michel Normand, « Voyager à tous prix : la fabrique des tarifs », *Le Monde Magazine*, 8 April 2011. In other instances, however, the SNCF admitted that deep-discount seats could be made available for sales again when faced with a large number of cancellations.

the revenue management analyst from correcting the discount allocation decision. At the SNCF, a fare class closed was a fare class closed, which implies a quite different form of exposure to errors. It is now easy to see how the algorithm represents an orderly disposition of the market, a computing configuration with some moral properties that ensure the fairness of pricing. There are, as I have pointed out, two conceptions of fairness which correspond to two algorithmic solutions for determining discount seat allocation—namely, the ascendant revenue management and the unrestricted revenue management. The first focuses on the scope in price changes, the rational nexus between the service offered and its price in order to re-establish trust between the public company and its users. The second conception, devoid of any social ambition, makes no statement about equity, but rather seems to be the result of the application of Pareto efficiency to the discount allocation decision.

The American Airlines approach was not optimal, as the authors themselves recognise.⁶⁸ This property is of central concern to many actors in the industry. And the notion of optimality does not refer here only to the benefits in terms of revenue or cost savings to companies. It is understood above all as a mathematical property.⁶⁹ For lack of finding the *right price*, what a heuristic allows compared to an optimal solution is at once a temporal reduction and a spatial enlargement. In terms of time, the use of a heuristic for determining discount allocation has two aspects. First, where there is no optimal solution readily available—which was the case at the time when American Airlines began to develop its revenue management system—it may be profitable to use a heuristic. Such an approximate solution is indeed often used in situations, such as a business setting, where time constraints

⁶⁸ Barry C. Smith, John F. Leimkuhler, Ross M. Darrow, ‘Yield Management at American Airlines,’ *op. cit.*, p. 16.

⁶⁹ It seems to me that the issue of optimality and its application in the economic sphere and more generally in that of social organisation constitutes a subject in its own right, which is only partially addressed here. For some preliminary elements of a ‘sociology of optimality’ in the case of telecommunication traffic in France, see Alexandra Bidet, « Quatre mesures du téléphone : L’invention d’une gestion téléphonique », *Economies et sociétés*, série AB « économie du travail », ISMEA, 25, 2005, p. 601-24.

force an approach in which faster application development is given priority over full functionality and performance. Second, by reducing the overall complexity of a problem, a heuristic can result in execution time gain over the optimal solution. This is of particular importance in this context, and given the limitations of computational performance at the time, where the discount allocation decision is updated on a regular basis (along with the overbooking level). In terms of space, now, AADT may want to use a heuristic because other aspects of the problem, specific to an organisation or an industry, can easily be incorporated while maintaining computational efficiency. By effectively reducing a large problem into smaller and more manageable sub-problems, the marginal revenue approach for determining seat allocation makes the American Airlines system more flexible and thus more adaptable to other business settings. Nevertheless, I will now show how central the notion of optimality remains and how the technical device expresses a certain utopia of accuracy.

I have focused on a specific case: that of American Airlines. We have seen the circumstances that allowed the company to establish itself as a key figure in the field of revenue management, and thus to position itself favourably in the nascent industry of dynamic pricing systems. We have seen, in the case of the SNCF, some moral issues involved by these tools when it comes to solving the problem of determining the number of discount seats and that of allocating these fares. We have seen how the pricing process characteristic of revenue management articulates in a pragmatic way a series of arguments on price optimality: prices now require to be subject to a whole work of adjustment and technical compromises. I propose to pursue this exploration further in two directions. First of all, by analysing the theoretical arguments which are mobilised to promote the methods of revenue management. Second of all, by examining the way in which these arguments are summoned in a concrete situation: the development of a revenue and pricing management system for hotel properties.

3. The Economic Representations of Price Setting: Scientific Rhetoric and Optimality of Prices

To understand the economic representations surrounding these pricing tools, I have chosen to delve into a number of texts, taken from the vast literature in operational research, which have directly addressed the issue of revenue and pricing management. Operational research—also called management science—has its origins in the Second World War period, in the planning activities of the Allied armed forces requiring the integration of multiple capacities (equipment, tactics, and logistics) into combat.⁷⁰ It started to constitute a distinct discipline in the 1950s in the United States and the United Kingdom, the main applications being in transportation management, inter-industry exchange modelling (input-output analysis) and resource allocation (activity analysis), and has evolved since then in parallel with the computerisation of the economy. Close to the concerns of game theory and industrial economics—although more empirically oriented—operational research represents a vast field of theories and practices, which explicitly aims at mathematizing social issues, rationalising organisational processes, and rationalising human behaviours too. The major notion is that of ‘optimality’: optimising defence by making the best use of available means had been the concern of operational research and logistics in wartime; maximising utilities and profits, minimising risks and costs, optimising resource allocations were the objectives of the post-war years. Optimality was already a major element of the programme of the marginalists in economics, but it was exclusively based on an analytical and variational form. It takes on a new form here, more algorithmic and combinatorial.

In past decades, revenue management has established itself as one of the central research subjects in the field of operational research. The Institute for Operations Research and the Management Sciences (INFORMS), an international society for practitioners and specialists in operational research and a key actor in

⁷⁰ William Thomas, *Rational Action: The Science of Policy in Britain and America, 1940-1960*, Cambridge, MA: MIT Press, 2015. On the post-war economics and the birth of game theory, see also Philip Mirowski, *Machine Dreams: Economics Becomes a Cyborg Science*, Cambridge, MA: Cambridge University Press, 2002.

knowledge dissemination in operational research, played a decisive role in this process.⁷¹ In 1998, it formed a specific body within it to promote revenue management, by the organisation of a two-day annual conference on the topics of revenue management and pricing and via the creation of a number of prizes to reward critical contributions to the field, and to disseminate revenue management principles and methods to students in higher education, business schools in particular.⁷² In 2002, INFORMS started, as a result of the growing appreciation of the subject, the publication of the *Journal of Pricing and Revenue Management* and, in 2004, it awarded its first annual section prize, the INFORMS Revenue Management and Pricing Section Prize, to the reference handbook on *The Theory and Practice of Revenue Management*, which provides a comprehensive overview of nearly 600 references on the topic.⁷³ I will now examine successively the content of two of the best known contributions in this academic field that directly address the issue of revenue management: the seminal paper of Kenneth Littlewood and the proposition of Peter P. Belobaba for the seat inventory control problem.⁷⁴

First Concept: Littlewood's Rule

The paper of Littlewood on the discount seat allocation problem was presented at the 12th AGIFORS (Airline Group of the International Federation of Operational

⁷¹ <https://www.informs.org/> [consulted on 5 May 2017]

⁷² Robert L. Phillips, 'Teaching Pricing and Revenue Optimization,' *INFORMS Transactions on Education*, 4 (1), 2006, p. 1-10.

⁷³ Kalyan T. Talluri and Garrett J. van Ryzin, *The Theory and Practice of Revenue Management*, *op. cit.*

⁷⁴ Both contributions received the Revenue Management and Pricing Section Historical Prize awarded of INFORMS, in 2004 and 2006 respectively. Kenneth Littlewood, 'Forecasting and Control of Passenger Bookings,' *art. cit.*; Peter P. Belobaba, *Air Travel Demand and Airline Inventory Seat Inventory Management*, *op. cit.*; Peter P. Belobaba, 'Airline Yield Management: An Overview of Seat Inventory Control,' *Transportation Science*, 21 (2), 1987, p. 63-73; Peter P. Belobaba, 'Application of a Probabilistic Decision Model to Airline Seat Inventory Control,' *Operations Research*, 37 (2), 1989, p. 183-97.

Research Societies) Symposium in October 1972. At the time, the deregulation of the airline industry was not on the agenda yet, which gives to this text a certain precursory status. The starting point is the recognition that reservations systems are not only record-keeping devices but that the data collected by them can be used to make for-profit decisions (in accountancy terms, they can be considered as a profit centre rather than a cost centre):

The introduction of sophisticated computer reservations systems provides an important source of data for various operational research studies. This paper will demonstrate how the Operational Research Branch in BOAC [*British Overseas Airways Corporation*] has used the information from the BOADICEA reservations system to help in maximising yield by flight.⁷⁵

The main argument is simple. It refers to the control and management of the reservations inventory and how to increase (to maximise, if possible) company profitability. When all passengers on an airplane are paying the same fare, overbooking provides the complete booking control policy. In the early 1970s, airlines, like BOAC, began offering advance purchase excursion (APEX) fares in international markets—Littlewood also mentions the use of discount fares when dealing with categories such as groups or staff. Because fares differ, airlines should now control availability according to the fare paid. The basic principle is that of maximising the revenue received on a particular flight rather than maximising the number of passengers carried. This innovation is justified by the idea that price adjustments ensure a certain economic efficiency:

Surveys indicate that there is a strong tendency for low-yield passengers to book earlier than high-yield passengers. If reservations are accepted on a ‘first come first served’ basis, the low-yield passenger will therefore get a higher standard of service [*defined as the probability that a passenger gets a reservation on the first flight of her choice*] than will the high-yield passenger. This situation is probably neither in the airlines’ nor the passengers’ interest. If the acceptance of a low-yield passenger results in the subsequent rejections of a high-yield passenger, the airline loses revenue. There is evidence also that standard of service is more important to the high-yield passenger. The low-yield passenger is probably much more prepared

⁷⁵ Kenneth Littlewood, ‘Forecasting and Control of Passenger Bookings,’ *art. cit.*, p. 111.

to be directed towards those flights on which the airline would prefer him to fly. All these arguments demonstrate the desirability of having a method of controlling low-yield fares.⁷⁶

It is easy to recognise here some of the basic elements of welfare economics. It is noteworthy how simplified this argument is: in spite of some empirical allusions, Littlewood uses no technical explanations nor authoritative references. In fact, Littlewood expresses an intuition that is self-evident as long as one considers the market from a neoclassical perspective: the allocation thus determined approaches a Pareto optimal allocation since it has been possible to improve the situation of certain actors (airline and low-revenue passengers) without causing a deterioration in that of the others (high-revenue passengers).

Littlewood acknowledges that significant obstacles associated with the implementation of the presented methods of passenger forecasting and revenue control remained—particularly the fact that very few fare types were actually recognised at reservation time and that the revenue improvement observed was not so great. Nevertheless, his paper is considered a seminal work in the field of revenue management and it established the foundations for many of the yield control models which have been subsequently developed.

Second Concept: Expected Marginal Seat Revenue

The proposition of Belobaba was formulated after airline deregulation, at a time when the practice of charging different prices for identical seats on the same aircraft flight was widespread in airlines. It first appeared in a doctoral thesis, written in the mid-1980s within the Flight Transportation Laboratory and the Department of Aeronautics and Astronautics of MIT⁷⁷ and submitted in 1987, which then led to the publication of two distinct articles in 1987 and 1989.

The first paper can be reviewed more quickly. It gives an indication of the development of the mathematical models in terms of accuracy and in terms of what

⁷⁶ Kenneth Littlewood, *ibid.*, p. 118.

⁷⁷ Massachusetts Institute of Technology.

had been made possible by the advances in computer technology. In particular, the findings of a survey conducted between August and December 1984 of representatives of eight North American airlines are discussed. Here is what the author concludes about the seat inventory control practices of the time:

The least advanced aspect of yield management and seat inventory control at all of the airlines surveyed is that of booking limit adjustment to maximise flight revenues. This task is the most important component of seat inventory control, yet it remains dependent on human judgment rather than systemic analysis. When an airline's reservations monitoring system flags a flight for which actual bookings approach any one of the limits or the threshold set for that flight, a decision must be made either to increase the availability of seats in the relevant fare class or to allow the system to close it down to additional reservations. This decision is currently being made by individuals or groups of individuals on the basis of experience and judgment at every airline surveyed, although the ongoing development of decision support tools is designed to reduce the amount of guesswork involved.⁷⁸

What is of interest here is the link between the argument of optimal booking limits and that of the demotion of human judgment. From the practitioners' point of view, the argumentation of Belobaba may not appear very sensible—in particular for the seat inventory controllers, because it amounts to denying their expertise. From an economic perspective, however, it is very clear. This issue is optimality, that is, the ability to set and adjust fare class booking limits so that supply equates demand. The automation of the seat inventory control function is, according to the author, necessary to achieve this economic equilibrium: changes in the marketplace which can impact customer demand have to be immediately reflected on the company's fares; sophisticated mathematical methods are used to determine the optimal seat allocation for a particular flight; the fare class booking limits are the outcome of a dynamic process in which decisions are made on a consistent basis through procedures established in the algorithm, which allows for evaluations and improvements. The machine is considered to be in a better position than the fickle contribution of human actors to reinforce these relationships. The proposition of

⁷⁸ Peter P. Belobaba, 'Airline Yield Management,' *art. cit.*, p. 67.

Belobaba remains moderate, despite everything, as it preserves a function for the human agents in the seat inventory control process:

Such algorithms will not eliminate the need for human judgment in seat inventory control entirely since any optimal solution would be probabilistic in nature and would be derived from forecasts based on historical data. There will always be variables that cannot be accounted for in such algorithms, including rapid changes in the competitive environment of airline markets and the occurrence of unexpected events that affect flight bookings. The objective in developing optimization models for seat inventory control is to allow yield management agents to focus their efforts on these variables by making routine tasks more systematic.⁷⁹

At this stage in the development of revenue management systems—in 1984—algorithms for finding the fare class booking limits were still in the planning phase. In the second half of the 1980s, airlines began implementing these tools. The device proposed in 1989 by Belobaba, the Automatic Booking Limit System (ABLS), is part and parcel of the debate on the automation of the seat inventory control function. It is a computerised system, which makes use of the famous Expected Marginal Seat Revenue (EMSR) decision model, to set and revise booking limits periodically prior to flight departure. The objective is the same as in the previous proposition: developing a revenue management system which increases economic efficiency and minimises the allocation errors in finding the optimal seat protection levels. ABLs was developed and implemented at Western Airlines during 1986, and the revenue impact of this automated approach was tested during the first three months of 1987—the purchase of Western by Delta Air Lines that same year brought an end to the ABLs experience.

As implemented at Western Airlines, ABLs established a division of work between the machine and its user. The computer provided the analysts with specific recommendations of what the fare class booking limits should be, based on a systematic evaluation of the input data (expected demand for each fare class and average revenue associated with each class). If the analyst agreed with the recommended limits, these were loaded into the reservations system. If not, the analyst could override the recommendations manually. Indeed, due to many

⁷⁹ Peter P. Belobaba, *ibid.*, p. 67.

imperfections in the system by the end of 1986, ABLIS was designed to allow analyst intervention where revenue potential was thought to be significant and where estimates of the future revenue or demand were not valid.

Heuristics versus Optimal Models: A Rhetorical Partition

The seat inventory control problem has become, since then, the subject of intense discussions among academics and practitioners, and Belobaba's EMSR constitutes a fundamental reference point in this debate. 'Interestingly, the deficiencies in that paper were part of the reason academics got involved in the topic,' explains one of the authors of the reference handbook on revenue management. 'It was clear that the kind of results Belobaba was publishing wasn't the optimal policy, that wasn't the optimal way to manage the system. So there was a flowering of papers that appeared after that, basically through more rigorist methods proving what the optimal policy for this particular problem was' (Interview, 17 July 2012).

What emerged was a 'producers' market,' as understood by Harrison C. White, in which scholars will seek market niches to maximise reputation and minimise competition.⁸⁰ The field of revenue management thus grew in new directions according to scholars' own interests and sensitivities: basic or applied research, airlines or other industries, teaching or research activities, 'knowledge for knowledge' or consulting, positive or normative, etc. What we see is an enlargement as well as a scattering of the discipline, starting in the late 1980s. Somewhat schematically, it can be said that, since then, revenue management has been divided into two main areas of expertise: a more practical and organisation-

⁸⁰ Harrison C. White, 'Where Do Markets Come From?' *American Journal of Sociology*, 87 (3), 1981, p. 517-48. This idea can be found in the work of Pierre Bourdieu. As the latter puts it, the scientific field is most distinctive in the extent to which producers tend to have no other clients but their direct competitors. Scientists devote much of their time and energy to reading about the work done by their rivals: they continuously observe each other, compare themselves, and infer from this what their research orientation is going to be. Pierre Bourdieu, 'The Social Space and the Genesis of Groups,' *Theory and Society*, 14 (6), 1985 [1984], p. 723-44.

and industry-oriented approach developed by Belobaba at MIT (or Sheryl E. Kimes at Cornell on the hotel industry); and a more theoretical and normative approach, of which the models bloat the handbook of Kalyan T. Talluri and Garrett J. van Ryzin, and the aim is to find optimal solutions to the seat inventory control problem, rather than heuristics.⁸¹ Mise en avant par ces derniers auteurs, cette division théorique est, en réalité, une opération rhétorique.⁸²

The proposition of Belobaba falls into this first category, according to which solving the seat inventory control problem is a case of integrating and to ensuring consistency between distinct tools, rather than a unique optimal mechanism. Yet, despite not being mathematically optimal, the EMRS models have been widely used in practice. One actor in the field confirms: ‘Most airline, hotel, rental car and cruise line revenue management systems currently in use today utilise EMSRa, EMSRb or some variant thereof in determining booking limits.’⁸³ I will briefly outline some of the main reasons for this state of affairs. I will borrow the first two from Talluri and van Ryzin. Here is what explains, according to them, the lack of success of exact optimisation models among practitioners:

The first is simply a case of practice being one step ahead of the underlying theory. As mentioned, in the airline industry the practice of using capacity controls to manage multiple classes quickly gained popularity following deregulation in the mid-1970s. But this predates the theory of optimal controls by more than a decade. The only known optimal controls in the 1970s were Littlewood’s results for the two-class problem. As a result, heuristics were developed for the general n -class problem. During the decade following deregulation, RM software embedded these heuristics, and people grew accustomed to thinking in terms of them. The inertia

⁸¹ Kalyan T. Talluri and Garrett J. van Ryzin, *The Theory and Practice of Revenue Management*, *op. cit.* A formal comparison between heuristic and optimal solutions can be found in Appendix E at the end of this document.

⁸² Bruno Latour and Paolo Fabbri, « La rhétorique de la science », *Actes de la recherche en sciences sociales*, 13 (1), 1977, p. 81-95.

⁸³ Larry R. Weatherford, ‘EMSR versus EMSU: Revenue or utility?’, *Journal of Revenue and Pricing Management*, 3 (3), 2004, p. 277-84, p. 278.

generated from this early use of the heuristics is one reason for their continued popularity today.⁸⁴

What the authors highlight here is a well-known phenomenon to institutional economists, namely path dependency: decisions taken at the beginning of the period channel subsequent developments in a certain direction.⁸⁵ The second reason is the received idea whereby the development and implementation of optimal models in the system represents significant costs (although, the authors claim, these costs are not as high as some would say):

Heuristics are also widely used because they are simpler to code, quicker to run, and generate revenues that in many cases are close to optimal. Indeed, many practitioners in the airline industry simply believe that even the modest effort of computing optimal controls is not worth the benefit they provide in improved revenue performance. Proponents of heuristics argue that the potential improvement from getting better revenue data and improving demand forecasts swamps the gains from using optimal controls—reflecting the philosophy that it is better to be ‘approximately right’ than it is to be ‘precisely wrong.’

While these points are well taken, such criticisms are somewhat misdirected. For starters, using optimal controls does not mean one has to give up on improvements in other areas, such as forecasting. These activities are not mutually exclusive, though an understaffed development group might very well consider refining optimization modules a low-priority task. Yet given the very modest cost of coding and computing optimal controls, the strong objections to the use of optimal controls are often not entirely rational.⁸⁶

⁸⁴ Kalyan T. Talluri and Garrett J. van Ryzin, *The Theory and Practice of Revenue Management*, *op. cit.*, p. 44.

⁸⁵ See, for example, Paul A. David, ‘Clio and the Economics of QWERTY,’ *The American Economic Review*, 75 (2), 1985, p. 332-7.

⁸⁶ Kalyan T. Talluri and Garrett J. van Ryzin, *ibid.*, p. 45.

The sociology of translation indicates a third factor for the success of EMSR models. To be successful, these models had to have a ‘good spokesman.’⁸⁷ After his dissertation in 1987, Belobaba continued at the Flight Transportation Laboratory of MIT concurrently with his consulting activities: first at Delta Air Lines, which purchased Western Airlines; then at other carriers and some software companies.⁸⁸ It is noteworthy that, beyond this classic form of consulting, he could rely on what became to be known as the MIT/PODS Revenue Management Research Consortium.⁸⁹ With an initial membership of Continental, Northwest, KLM, SAS, Lufthansa and Swissair, this research consortium was launched in 1999 to make airlines benefit from the insights and experience gained through the development of the Passenger Origin-Destination Simulator, or PODS. PODS began to be developed at Boeing and MIT (with Belobaba) in the mid-1990s and has evolved in parallel with technology in revenue management. The objective of this integrated simulation is to simulate and test the impact of revenue management systems on some airlines’ key performance indicators (such as market shares, load factors, and revenues).⁹⁰ It is likely that the singular position Belobaba occupies, midway

⁸⁷ Madeleine Akrich, Michel Callon and Bruno Latour, « À quoi tient le succès des innovations. L'art de choisir les bons porte-parole », *Gérer et comprendre*, 12, 1988, p. 14-29.

⁸⁸ In a book already cited, E. Andrew Boyd reveals the connections between Belobaba and people of PROS (Pricing and Revenue Optimization Solutions), a software company for which the latter worked as a consultant: ‘Woestemeyer [PROS’s founder] connected with a PhD student named Peter Belobaba.’ ... ‘Belobaba would play an important role in shaping PROS’s scientific direction for many years.’ E. Andrew Boyd, *The Future of Pricing*, *op. cit.*, p. 19.

⁸⁹ <http://podsresearch.com/history.html> [Last consulted on 5 May 2017]

⁹⁰ It is worth noting the explicit references made by Belobaba to economics when he enumerates the first simulations and findings that PODS provided: ‘One of the questions that Boeing had was “If everybody puts in the same really good RM system, in the end, are you back to where you started?” That was one of the biggest contributions of PODS that the answer is “no.” Now, in retrospect, for obvious reasons: if all the competitors in a market are more intelligent about optimizing and get in them willingness-to-pay out of the

between the academic and business worlds, with what this entails in terms of interpersonal networking, has fostered the dissemination and implementation of EMSR models in organisations. The automation of pricing decisions became a service industry: the actors could now choose between several available revenue management tools. As the automation was now taken for granted and it is the development of software, of particular features, which was highlighted. This implies that the modelling efforts on seat inventory control must focus on finer and finer details; a good example of this kind of refinement is the opposition between ‘ascendant revenue management’ and ‘unrestricted revenue management.’

Revenue Management as Price Discrimination Practice

It is difficult not to consider the economic concepts of price discrimination and product differentiation as the underlying rationale for the evolution of current marketing practices in the airline industry:

Pricing in airline markets, which are oligopolistic in most cases, is well-suited to this concept of differential pricing. ... Differential pricing of identical seats on a flight departure can enable the airline to generate the additional revenue required to cover the total costs of the flight from those passengers using the reduced fare options. Airline efficiency can be enhanced, as better use of existing equipment with its sunk costs can be realized by filling otherwise empty seats.

From the consumer's perspective, the practice of differential pricing by airlines can in theory benefit *all* passengers, resulting in a *pareto optimal* market situation. As long as the full-fare passengers do not pay more than they would have in the absence of differential pricing, they are no worse off. ... Low-fare passengers

passengers, everybody benefits. That's just fundamental economics.' ... 'Another major contribution of PODS is that if one airline puts in a more sophisticated RM system, it definitely gains revenue, but the other airline can actually lose revenue. So the movement is: one airline goes up, the other airline goes down. These are things that shouldn't be surprising anybody who knows anything about competition and economics but, back in the 1990s, there was some uncertainty about whether all this RM science really did anything for the industry or whether that was just a market share exchange' (Interview, 17 July 2012).

benefit from the availability of lower-priced air travel options, either by saving money on a planned trip or by being able to take a trip that would not otherwise have been taken.⁹¹

Belobaba explains how mathematical models, such as the EMSR framework, can be used to determine recommended booking limits, dynamically revised during the booking process, to make sure that a maximum number of seats can be sold at the equilibrium price. Effective implementation of fare class booking limits allows airlines to generate incremental revenues without incurring corresponding increases in operating costs. More than this, the EMSR decision model also ensures the fairness of the allocation of fixed costs and resources. The market thus appears to us as more equitable, in particular for the low-revenue passengers given that remaining seats were deemed to be a surplus and made available to them. This apparatus takes on a number of economic representations, coming from, in particular, the strange, very peculiar world of microeconomics, populated with fictional characters who express their preferences according to their utility functions:

Regardless of how rigidly we interpret the notion, utility maximization seems to be a reasonable basis for the development of an individual choice framework for air travel decisions. Several other components of the classical micro-economic model of consumer choice can also be incorporated into this framework, although modifications to account for the unique nature of transportation demand are required. Most important of these is the derived nature of transportation demand. That is, few individuals travel for the sake of travel itself. ... A related characteristic of transportation is that it is purchased not for its quantity, but rather for its attributes.⁹²

⁹¹ Peter P. Belobaba, *Air Travel Demand and Airline Seat Inventory Management*, *op. cit.*, p. 16-7.

⁹² It is a direct reference to the famous contribution in microeconomics of Kelvin J. Lancaster, for whom 'the good, per se, does not give utility to the consumer; it possesses characteristics, and these characteristics give rise to utility.' Kelvin J. Lancaster, 'A New Approach to Consumer Theory,' *Journal of Political Economy*, 84, 1966, p. 132-57, p. 134.

Given the derived nature of transportation demand, consumers will want to minimize travel time, cost, discomfort and inconvenience for a trip with a given level of perceived benefits. The concept of utility thus represents a generalized function that takes into account the pleasant and unpleasant components of making a trip and can form the basis of consumer choice.⁹³

Revenue management is one of the practical applications of the theory of price discrimination, as it was formulated by Jules Dupuit in the middle of the nineteenth century.⁹⁴ The articles that I have presented here pursue the ideal of first-degree price discrimination, already indicated by the French economist-engineer when he recommended, in order to extend the utilisation of certain services, that the entrepreneur attempt to ‘impose on each traveller, on each merchandise, only a price inferior to the one which would prevent them from using the road.’⁹⁵ I will briefly describe what price discrimination is. To understand how price discrimination can be a viable strategy for a firm, it is necessary to assume that the firm has market power of some sort, either monopoly or oligopoly power. The firm under this market structure will typically seek to sell additional output at a price in excess of its marginal cost and if it can find a way to do so without lowering the price on the units it is currently selling. Price discrimination requires, among other conditions, that the firm also has a way to sort consumers, whether it be with respect to some exogenous category such as age, or on the basis of some endogenous category such as time of purchase. By multiplying these categories indefinitely, the consumers could be made to pay over all the utility they derive from the purchase of a particular unit.

⁹³ Peter P. Belobaba, *ibid.*, p. 38-9.

⁹⁴ Robert B. Ekelund, ‘Price Discrimination and Product Differentiation in Economic Theory: An Early Analysis,’ *The Quarterly Journal of Economics*, 84 (2), 1970, p. 268-78.

⁹⁵ Jules Dupuit, ‘On Tolls and Transport Charges,’ in *The International Economic Papers*, Elizabeth Henderson (trans.), London: Macmillan and Co., 1962 [1849], p. 21. For the formal taxonomy of the degrees of discrimination, see Arthur C. Pigou, *Economics of Welfare*, London: Macmillan and Co., 4th ed., 1962 [1920], p. 277. See also his earlier paper in which he found first-degree discrimination to be of only academic interest; Arthur C. Pigou, ‘Monopoly and Consumers’ Surplus,’ *Economic Journal*, XIV, 1904.

Perfect price discrimination, of course, is a very difficult matter in practice. Nevertheless, it constitutes a purely theoretical horizon towards which the conceptualisations of contemporary operational research are related. We know that instances of price discrimination of some degree can be found in economic life—Jules Dupuit himself found in railways an empirical illustration of his idea.⁹⁶ But what is of interest here, is to be able find both in the analytical abstractions of microeconomics and in the algorithmic models I have just reviewed the same arguments: demand can be segmented; price sensitivity varies across these segments; bundles of product/service features must be constructed to correlate consumers' willingness-to-pay with their preferences and purchase behaviours; the prices at which these products are offered on the market must be determined by means of optimisation.

We have seen how, in the case of American Airlines, a number of specialists tried to claim a monopoly on the techniques and know-hows of revenue and pricing management. Now we see how the conceptual and linguistic representations are the subject of a similar process of construction and appropriation, and the means of this process appears to be a particular form of rhetoric. It remains to me, however, to clarify, based on a concrete case, what seems to be a quasi-causal relationship between the politic and the performative, and to analyse, in this situation which is eminently political, the emergence of performative effects and arguments relating to the optimality of mathematical modelling. Saying that economic sciences have influence on the way the actors think about and build the markets is an assertion which is useful—while the attempts to naturalise market economy by its inscription

⁹⁶ So he writes: 'It is not because of the few thousand francs which would have to be spent to put a roof over the third-class carriages or to upholster the third-class seats that some company or other has open carriages with wooden benches.' ... 'What the company is trying to do is to prevent the passengers who can pay the second-class fare from traveling third class; it hits the poor, not because it wants to hurt them, but to frighten the rich.' ... 'And it is again for the same reason that the companies, having proved almost cruel to third-class passengers and mean to second-class ones, become lavish in dealing with first-class passengers. Having refused the poor what is necessary, they give the rich what is superfluous.' Jules Dupuit, 'On Tolls and Transport Charges,' *art. cit.*, p. 20.

in human nature remain vivid and strong—but far too naïve. I prefer to insist on the complexity of processes of formation and diffusion of knowledge and, in particular, on this fundamental irresolution on the status of theoretical statements of economics: we do not truly know where the performative stops and where the predictive begins.

4. Making and Explaining Prices: A Case of Revenue Management in the Hotel Industry

Selling Price versus Suggested Price

I have tried to find a place and time where the justification of revenue management became a practical matter. It is the elaboration by a French start-up, PriceMatch, of what is called a SaaS (Software as a Service) solution for price setting in the hotel industry: the determination of price recommendations, by means of a software licensed on a subscription basis and centrally hosted, for the services—in particular hotel rooms—offered for sale by hotel properties. In practice, it is a secondary case study, at least in comparison with the examples mentioned hereinbefore in the airline and railways industries. Nevertheless, the case is interesting for several reasons. On the one hand, the solution under the SaaS model, appears as a ‘disruptive’ innovation with regard to the commercial exploitation of revenue management systems. It is a method which leads to significant reduction in costs for the users, by transferring the expenditures of acquisition and maintenance to the software provider. On the other hand, the solution developed by PriceMatch can be understood as the realisation, in a certain form, of the theoretical constructs that I have mentioned in the second section of this presentation, and offers a convenient platform to question the performativity thesis.

What is the particular story of this system? First it is important to understand the singularity of the service offered by revenue management software vendors: a price recommendation. A price recommendation or price suggestion is by definition discretionary: the hotel manager or any responsible of pricing matters in the property can decide to follow, or not, the price suggestion displayed on the platform and to upload this price on the website or any other sales channels, OTA⁹⁷ in particular. This product has a sensitive status over which it is easy to sense the political implications, or more precisely the rhetorical significance.⁹⁸ Indeed, the

⁹⁷ Online Travel Agency.

⁹⁸ For a sociological approach to the tensions between the rhetorical and the technical, see Bruce G. Carruthers and Wendy N. Espeland, ‘Accounting for Rationality: Double-Entry

pricing algorithm is supposed to enable the execution of a technical operation of which the outcome is ordinarily seen as a neutral form of information. Yet price recommendation, often regarded with suspicion by the actors, means that this outcome is also important in order to establish the legitimacy of the tool. Many adjustments need to be sought and found to reduce the gap between the positive and the normative, between what is calculated and what is expected by the users so that this suggestion looks convincing. In the case in point, this adjustment is made through the practical application of ad hoc rules, which intervene after the optimisation calculation.

Although the price suggestion is only one of the elements provided by the solution—already existing data stored in reservations systems, or PMSs⁹⁹, but presented in a clear and readable form is considered by the actors as a significant advantage of the platform¹⁰⁰—, it is easy to understand why it is a figure of crucial importance. It is the price that maximises the revenue and profit of a hotel property. It is used by the hotelier to determine the selling price of her rooms. And it is on its merits—its quality—that the hotelier will make the decision to extend, or not, her subscription. It entails the legitimacy of the expertise offered by PriceMatch. As we can see, this figure largely determines the success of the start-up. It is therefore easy to understand why many actors pay close attention to it. Members of the organisation may be interested in it for several reasons: engineers assess the performance of price suggestions made in the past to improve these values; account managers control the prices recommended by the algorithm, and adjust the parameters (weight of completion, number of days used to determine the reference price value, volume strategy versus revenue strategy, etc.) to obtain ‘acceptable’

Bookkeeping and the Rhetoric of Economic Rationality,’ *The American Journal of Sociology*, 97 (1), 1991, p. 31-69, on the case of double-entry bookkeeping.

⁹⁹ Property Management Systems.

¹⁰⁰ Occupancy rate, current price, median price of competitors, pick-up (i.e. the number of reservations picked up from a given point of time to a different point of time over the booking process), events that may influence local demand, for example, are all relevant information that users need to make their profit-maximising decisions.

suggestions but also to fix, on a case-by-case basis, some price suggestions they find ‘abnormal,’ when the setting would not provide any ‘satisfactory’ results.

The ‘Democratisation’ of Revenue Management Systems

Before the introduction of revenue management, room prices in the hotel industry were relatively fixed. Savvy customers could, however, get a discount on the displayed price for bookings made at the desk or over the phone. In France, a specific legal circumstance framed the direction of this negotiation: the obligation, to which hoteliers have been subjected since the end of the 1960s, to inform their clients about the prices charged in their properties.¹⁰¹ The maximum price, or rack (as it is called in the industry), is determined beforehand, often once a year, and displayed outside and inside the hotel. This means that a reservation can be made at a different price, at the discretion of the hotelier, as long as the price is lower than the rack price. We can recognise here the well-known practice of sales at sale prices or selloff, which characterised the retail industry. We can note that, in both cases, this is identical products that are sold at different prices. We also note that the former selling price is known to customers, as it is a legal obligation of retailers too,¹⁰² and that, in both cases, a stock or part of a stock is sold off at a reduced price. However, the reasons for discount are different: one, in the retail industry, is applied when a product is out of date, obsolete, or shows a lack of conformity; the other, in the hotel industry, intervenes to fill rooms that otherwise would remain empty and thus to improve the revenue of the property.

For the middle of the 1980s several revenue management solutions appeared, which addressed primarily the needs of large hotel chains.¹⁰³ A two-tier

¹⁰¹ See Arrêté du 18 décembre 2015 relatif à la publicité des prix des hébergements touristiques marchands autres que les meublés de tourisme et les établissements hôteliers de plein air, JORF n° 0299 du 26 décembre 2015, p. 24056, Texte n° 139.

¹⁰² Sales in France are regulated by the following text: LOI n° 2008-776 du 4 août 2008 de modernisation de l'économie, Art. 98.

¹⁰³ Robert G. Cross have told that John W. Marriott Jr., president of the hotel chain of the same name, heard about revenue management directly from American Airlines' president,

technology diffusion seemed to occur: the most powerful actors could develop their revenue management systems, either internally or by engaging the costly services of a software vendor; while the least well-endowed coming from the so-called ‘independent’ hotel industry had to settle for more rudimentary pricing technologies. ‘Most [vendors of revenue management systems] are not specifically addressing the needs of SMEs¹⁰⁴,’ warns in the late 1990s the consultancy firm Arthur Andersen on the behalf of the European Commission.¹⁰⁵

For many actors, it is necessary to make the technology ‘more accessible.’ The term ‘democracy’ is often used.¹⁰⁶ In recent years, it is mainly so-called ‘innovative’ companies, such as PriceMatch in France or Duetto in the United States, which will

Robert L. Crandall at a chance meeting in the mid-1980’s, avant d’appliquer ses principes au secteur hôtelier. This shift in the sales operation strategy of Marriott International would be, for the author, the first adoption of revenue management beyond the airlines. See Robert G. Cross, *Revenue Management, op. cit.*; Robert G. Cross, Jon A. Higbie, Zachary N. Cross, ‘Milestones in the application of analytical pricing and revenue management,’ *Journal of Revenue and Pricing Management*, 10 (1), 2011, p. 8-18.

¹⁰⁴ Small and Medium-sized Enterprises.

¹⁰⁵ For a survey of revenue management systems in 1990’s Europe, see European Commission, Directorate-General XXIII—Tourism Unit, *Yield Management in Small and Medium Sized Enterprises in the Tourist Industry: General Report*, drawn up by Arthur Andersen, Luxembourg: Office for Official Publications of the European Communities, 1997, p. 25 (quote). The case of the tourist industry in France is addresses in special section, see p. 129-42.

¹⁰⁶ This term remains problematic. It can be used in any case by a consultant or a revenue management software vendor to mean that a technology is made accessible to all hotels, regardless of their size. On the other hand, the phenomenon studied here cannot be confused with what some have called, advocating for it, a ‘technical democracy’ or ‘dialogical democracy.’ In the case in point, it is the very same specialists, whether they work for a software giant of the hotel industry or a start-up like PriceMatch, who take decisions on the technical aspects of the technology. Michel Callon, Pierre Lascoumes, and Yannick Barthe, *Agir dans un monde incertain. Essai sur la démocratie technique*, Paris: Le Seuil « La couleur des idées », 2001.

try to respond to this situation. It can be estimated that the recurrent cost of these new entrants is as much as twice as low as that of incumbent firms.¹⁰⁷ For a long time, before the emergence of this type of SaaS software, other solutions, as we have seen, were contemplated, and that of consulting firms specialising in hotel pricing issues seemed the most relevant for the independent hotel sector. A sort of revenue management, however unsophisticated it was, had already been used by most hotel directors who will eventually engage the services offered by PriceMatch. On a one-off basis, the hotelier, working in tandem with the consultant, will determine a number of values that will serve as reference points for pricing. Based upon market surveys, they (hotelier and consultant) will set the maximum price or rack at which a given room can be sold. They will also build the ‘annual calendar,’ that is, the price for each day of the year given the characteristics of the date. The day of the week, the month of the year, the presence of a holiday, or that of local events, are some factors that will impact demand, and thus price levels. More frequently, every day or every week, these prices will be looked at again and will be adjusted if need be according to the actual load factor of the property. For example, for an occupancy rate higher (or lower) than the expected rate, the hotelier will revise upwards (or downwards) the selling price for each room.

¹⁰⁷ The subscription amounts are between 250 and 400 euros for companies such as PriceMatch and Duetto and between 400 and 500 euros to pay for the services of software firms like IDeaS and Easy RMS, to which must be added a significant saving on installation and setting up costs estimated at 3,000 to 5,500 euros.

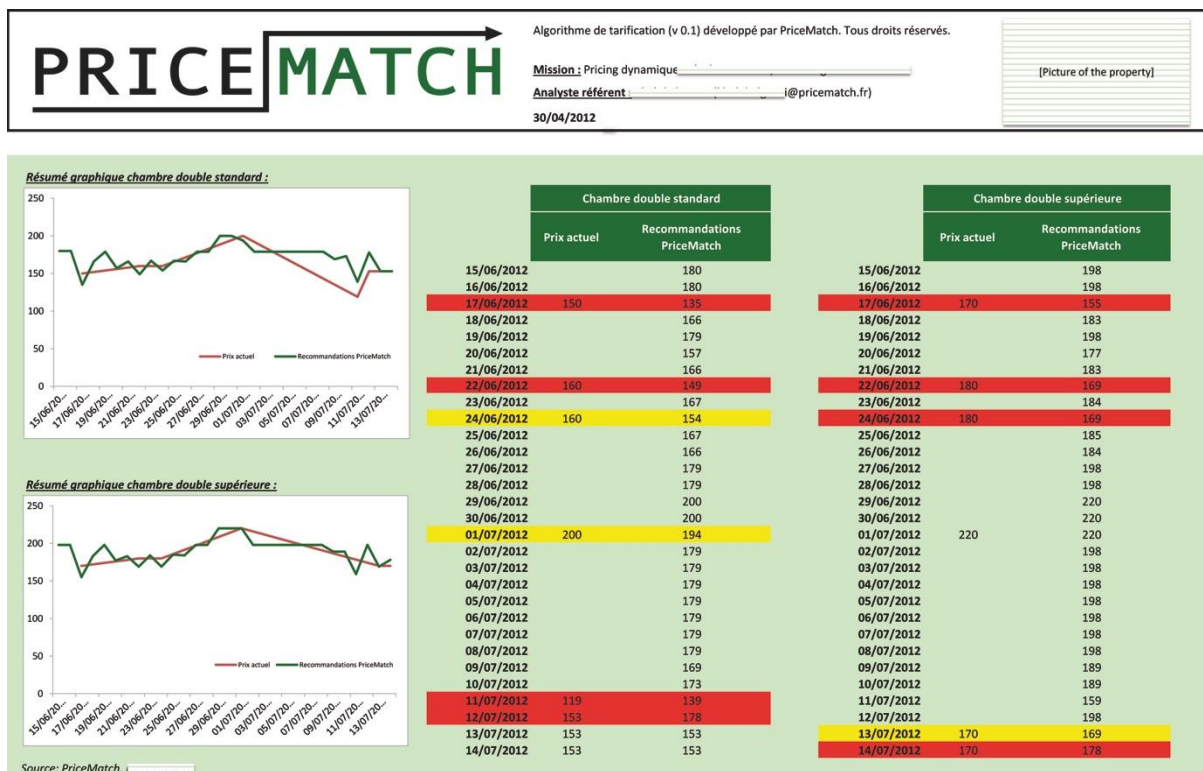


Figure II.3.1. Calendar view, June 2012.

Note: On the right hand side, two distinct tables—one for each room type—show the list of the actual prices and that of the price recommendations made by the algorithm for the coming thirty days and. On the left hand side, corresponding graphs represent the variations of the actual price (in red) and of the recommendation (in green). Also highlighted in the tables are the dates for which the gap between the actual price and the recommendation is relatively significant: cells turned yellow if the difference is less than five per cent and red if it is more than that.

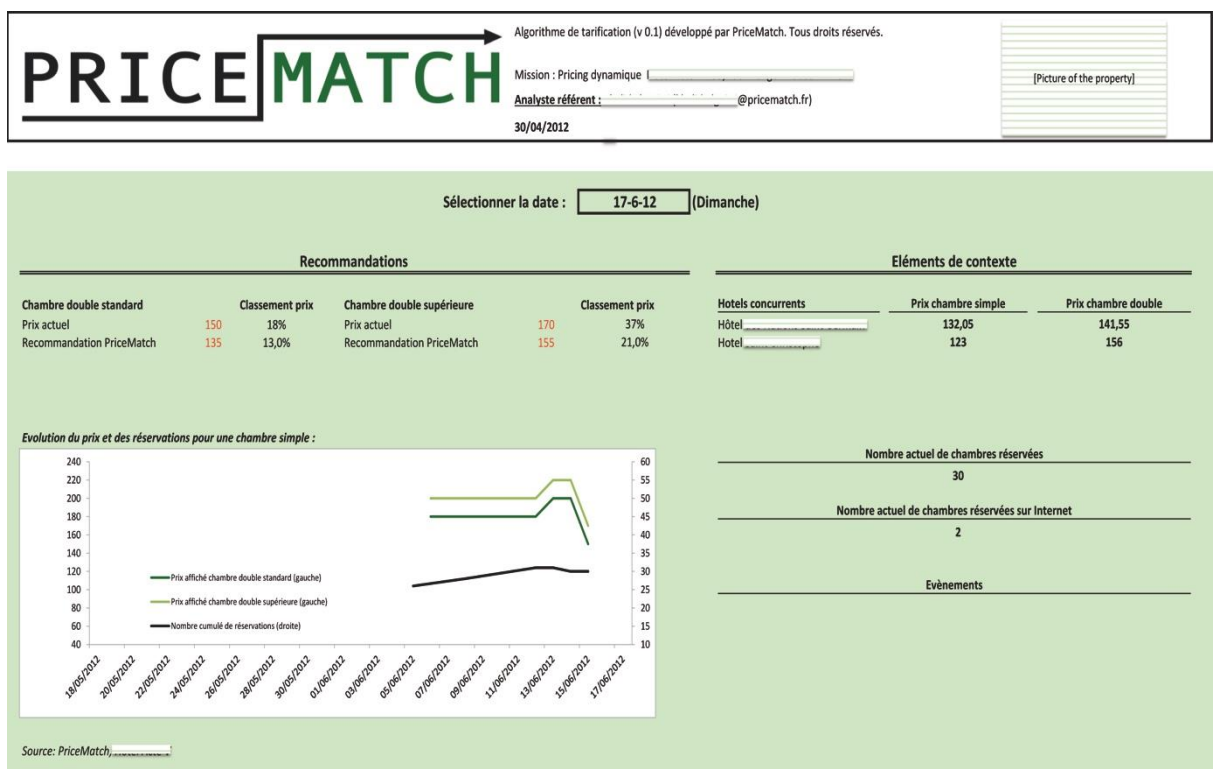


Figure II.3.2. Detailed view, June 2012.

Note: In addition to the information on price and recommendation given in the overview tab, other factors such as competitor prices and local events that may affect the demand are shown here. A graph also gives the evolution of the actual prices for each room type and reservations taken over the booking period for a given date.

The solution developed at PriceMatch follows a very similar pattern: aggregating all available information which may impact the local demand, then determining the price suggestion according to an optimisation model. From an algorithmic point of view, it is only a matter of applying the pricing principles which were already used by the hoteliers. But the solution is not self-evident. Each day, the hotelier receives via the platform a price suggestion for a given room and date, nothing less and nothing more. The service provided by the specialist is therefore reduced to its simplest form: a number (expressed in euros or national currency). The solution could not effectively be adopted without some *work of explanation*.¹⁰⁸ With the prototype or MVP¹⁰⁹, for example, the principle of price suggestion was difficult to read and still little developed in terms of transmission of information (see Figure 2). In response to several early users' questions concerning reliability of the result, PriceMatch tended to support its recommendations by providing a range of other quantitative data, such as the number of bookings made and prices of rival properties (see Figure 3). Moreover, as soon as the product was launched onto the market, some investors expressed their concern that hotel managers may not be ready to use the technology. 'Hoteliers are not engineers': it was thus necessary to 'educate' them so that they would understand that it is in their best interests to extend their subscription (Interview, 31 March 2016). At PriceMatch, this explanation work is carried out by the account managers whose job is precisely to provide ad hoc justification for the prices suggested by the platform. We will now see that the engineers and the algorithm also play their part in this.

¹⁰⁸ For a critical view on explanation, see Jacques Rancière, *The Ignorant Schoolmaster: Five Lessons in Intellectual Emancipation*, Kristin Ross (trans.), Stanford, CA: Stanford University Press, 1991 [1987]. For an English introduction and review, see Charles Bingham and Gert Biesta, *Jacques Rancière: Education, Truth, Emancipation*, New York, NY: Continuum, 2010.

¹⁰⁹ Minimum Viable Product.

Another Solution vis-à-vis the Suggestion 'to the Nearest Euro': Fare Classes

PriceMatch solution has very little to do with the promotions and destocking operations of the retail industry. For many actors, this revenue management system presents itself as the best way to rationalise pricing practices—and not a way to salvage the structure of sales at sale prices, which consists of selling off products in stock at a discounted price. To understand the specificity of this solution, it may be useful to compare it to another system also used to solve the hotel pricing problem. PROS, an North American provider of pricing software, and Walt Disney World Resort, introduced at the turn of the 2000s a revenue management system was later took by the other theme parks of the group.¹¹⁰ The aim was to set a selling price for the rooms of the hotel complex. The calculation is carried out, as it is almost always the case, on the basis of the history of past bookings. However, and this is precisely where this solution differs from the one devised by PriceMatch, the calculation is made using five predefined fare classes: first the rack, then four levels of discount corresponding respectively to 85, 70, 60, and 50 per cent of this maximum price.¹¹¹

With the solution chosen by PROS, it is quite clear that the price thus calculated cannot rigorously be optimal. The main reason is that the price jumps from one discount level to the next (in fact the algorithm allocates for each fare class a number of rooms that maximises the revenue; but other segments of demand can well be reached by introducing intermediate fare classes). The price is characterised by a certain 'rigidity.' A revenue management at Disneyland Paris considers this price structure too 'restrictive' because it does not allow to precisely target 'all the sensitivities' with regard to price of the clientele of the park. Engineers are the ones who choose the calculation parameters and who decide when the price difference is significant enough to justify the introduction of an additional fare category. This decision is not arbitrary at all: the larger the fare class, the more

¹¹⁰ E. Andrew Boyd, *The Future of Pricing*, op. cit. p. 94-102.

¹¹¹ In fact, PROS solution counts six fare classes, if we take into account the additional category for special offers, and twelve, the sales channel—direct via the call centre or the website, or indirectly through the travel agencies that collaborate with the hotel group—on which a reservation is made.

it contains price values, and the more robust the optimisation model. PROS did try to mitigate this extreme integration constraint, in particular by introducing a category with no predefined prices for special offers; however, they cannot multiply the number of fare classes ad infinitum (at the risk of creating categories devoid of any substance, empty shells, and thus impairing the performance of the model).

If we put the solution of PriceMatch and that of PROS side by side, we find one of the structuring oppositions in the scientific literature between revenue management models known as ‘quantity-based’ and ‘price-based’.¹¹² We can note that, in both cases, it is an algorithm that determines the price in accordance with a set of rules and priorities. We note as well that the notion of optimisation remains central, and that, in both cases, it is a question of maximising the revenue, and thus the profit of the property or the group. Still, the choice of the maximisation constraint seems to oppose two distinct ways of solving the problem of revenue management: one, at Disneyland, is ‘quantity based,’ that is, the primary demand-management decisions concern product rationing and availability control (how much to sell to whom, whether to accept or reject requests for products, and so on); the other, at PriceMatch, is ‘price based,’ i.e. the primary demand decisions are prices (how to price to various customer groups or how to vary prices over time). This theoretical distinction between these two categories of models is essentially a ‘semantic’ one for the actors.¹¹³ ‘Many hotels were already doing some sort of dynamic pricing,’ explains one founder of the start-up who has played a major role

¹¹² Kalyan T. Talluri and Garrett J. van Ryzin, *The Theory and Practice of Revenue Management*, *op. cit.*, p. 20-2.

¹¹³ ‘To me revenue management is essentially about controlling either the availability of the product or the price of the product, in response to market conditions, to try to maximise revenue. So in the book the way we split it up is between quantity control and price control.’ ... ‘But the objectives in both cases are sort of the same in that you want to respond to market conditions and you want to consider whatever constraints you have on the availability of the product or how much time you have to sell the product to generate as much revenue as possible. It’s just the nature of what it is that you’re controlling in the two cases.’ ... ‘So I think it’s kind of just a semantic thing really’ (Interview, 14 September 2011).

in the design of the tool. ‘The approach we had was to propose an *optimal* price of sale. This was a bit new, unexpected.’ ... ‘The idea of giving a price recommendation, and somehow of pretending that we know the optimal price of sale, is something *intriguing*¹¹⁴ to the hoteliers. *There is something magical in it*’ [Interview, 24 September 2014]. Although the price suggestion is the result of some mysterious process, it slips out of the simplifying categorisation of an inexhaustible reality. In this sense, it is a right price.

We recognise as well the distinction between heuristics and optimal solutions that is used as an argument to promote the models expounded in the publication of Kalyan T. Talluri and Garrett J. van Ryzin.¹¹⁵ But the idea here is not to act so the pricing algorithm would replace the ‘pricing scripts’¹¹⁶ used by hoteliers to set room prices in their properties. This kind of rationalisation—some would describe it as a form of nudging¹¹⁷—takes place in the context of a specific problem: a matter, altogether rather prosaic, of the commercialisation of a technology. In the business model chosen by PROS, the possibility that customers

¹¹⁴ It is noteworthy, for the issue at hand, the double meaning of the term ‘intriguing,’ which refers to something that arouses curiosity or interest, that fascinates, but also that has an element of secret, something that is illicit or detrimental to someone.

¹¹⁵ For introductions and reviews on methods for hotel revenue management, and in addition to the texts that I have explored above, see, e.g., Sheryl E. Kimes, ‘Pricing and revenue management,’ in Vithala R. Rao (ed.), *Handbook of pricing research in marketing*, Northampton, MA: Edward Elgar Publishing, 2009, p. 477-87; Larry R. Weatherford and Sheryl E. Kimes, ‘A comparison of forecasting methods for hotel revenue management,’ *International Journal of Forecasting*, 19 (3), 2003, p. 401-15.

¹¹⁶ The notion of ‘script’ has been applied in quite a meaningful way to price setting in contemporary art, see Olav Velthuis, *Talking Prices*, *op. cit.*, p. 116-31.

¹¹⁷ See James Wilk, ‘Mind, Nature and the Emerging Science of Change: An Introduction to Metamorphology,’ in Gustaaf C. Cornelis, Sonja Smets, and Jean Paul van Bendegem (eds.), *Metadebates on Science: The Blue Book of ‘Einstein Meets Magritte’*, Boston, MA: Kluwer Academic Publishers, 1999, p. 71-87; Richard H. Thaler, and Cass R. Sunstein, *Nudge: Improving Decisions about Health, Wealth, and Happiness*, New Haven, CT: Yale University Press, 2008.

would terminate their contract at any time is suspended: the hotel group cannot turn to a competitor without exposing itself to the threat of losing the specific assets invested in its collaboration with the software provider. On the contrary, the start-up offers a so-called ‘non-binding’ contract, that is, the decision to extend the collaboration, or not, arises every month (although the start-up has tried to encourage more permanent contracts by offering significant discounts for annual subscription, to improve its cash position). The challenge at PriceMatch therefore is to ensure that the hoteliers ‘buy it’, that is, they concur with each and every price suggested by the revenue management system (or rather this problem takes on a greater acuity than does the case previously considered).

The pricing algorithm, and especially the control rules that it incorporates, redistributes the agency in the production of prices from the analyst, without for all that ruling it out entirely. As seen, the rationalisation at work in the case of revenue management allows some degree of flexibility: the algorithm does not abolish the possibility of a role for what Peter Belobaba calls ‘human judgment’, but it allows revenue managers to focus their efforts on critical dates. But there is more. The idea of PriceMatch engineers is precisely to integrate this judgment *in* the algorithm so to speak, to address ‘not only the optimisation problem but also the concerns of the hotelier.’ Thus questioned on the algorithm’s rules of priority, one of the start-up cofounders explains: ‘We have to respect constraints which are not necessarily aligned with the optimisation interests of the hotelier. If we provide a hotelier with a recommendation that seems absurd to her, it is the whole tool that is being put into question. So you need to find *the right balance between actually optimising the selling price and reassuring the hotelier.*’ [Interview, 24 September 2014]. We can follow through the interviewee’s assertion: the algorithm is a rhetorical device because its purpose is not simply to inform but also to convince. In that, the price thus calculated cannot be considered a neutral, technical information; instead one must see it as a powerful argument in favour of the legitimacy of the start-up and the services it provides.¹¹⁸

¹¹⁸ Bruce G. Carruthers and Wendy N. Espeland, ‘Accounting for Rationality,’ *art. cit.*, p. 35.

How to ‘Perform’ a Price?

I have identified two types of rules that come into play, subsequent to the optimisation calculation of the suggested price: the algorithm include rules that are ‘technical’, on the one hand, and ‘rhetorical’ on the other. First, ‘technical rules’ ensure that the suggested price is between the minimum price and the rack set by the hotelier; that it matches the property’s price grid, if applicable; that a double room is always more expensive than a single room; that a $n+1$ -night stay is also always charged more than a n -night stay; etc. It is noteworthy that the algorithm also contains a variation of what I have called ‘ascendant revenue management.’ We have seen that, in the case of the French national railway, a rule made it technically impossible for revenue managers to reopen lower-value discount classes—that is, to make prices go down. Instead, the revenue management system developed by the start-up permits such downward changes in prices but only up to a certain limit. ‘Rhetorical rules’ deserve some more detailed attention. Again a distinction has to be made between rules that have to do with movements in suggested prices, their performance, and those that refer to local conditions of the property.

To attend to the issue of price performance, it seems useful to briefly return to PROS solution and note that, contrary to the users of PriceMatch online platform, revenue managers of Disneyland Paris could not observe directly the evolution of the suggested price over the booking period, nor that of the actual selling price. According to the engineers of PROS the revenue manager does not need to know of this: all that is significant for her is whether a change in prices is likely to yield additional revenue for the firm and, if so, how much this change has to be. The way the user interface was designed in the start-up may explain why the following rule was subsequently implemented: it ensures that the suggested price at day d cannot be ‘too’ far apart from its initial value at day $d-1$. In the case of PROS solution, erratic changes in prices is beyond the control of the analyst because, with this particular user interface, the price evolution is not displayed, it has not been made visible—although it is possible to obtain it at the cost of several operations of data retrieval and processing. With PriceMatch, on the contrary, excessive volatility (some sudden downward and upward adjustments in pricing) can immediately and

directly be detected by the user on her control panel. Changes in recommended prices thus become a strategic issue. One may respond that the distinction established between technical and rhetorical rules is very much artificial: the effect of a negative price, or a price above the legal limit set by the rack, would be just as harmful to PriceMatch's credibility and impact of their advice. In this specific sense, then, technical rules attempt to persuade and can therefore be analysed as rhetoric. Yet there is a fundamental difference between technical and rhetorical rules: that the latter cannot be revealed to the platform's users (unless PriceMatch would want to deliberately shoot itself in the foot).

It is easy to understand why the rhetorical rule I have given as an example—that embeds the suggested price in that of the night before—is inconvenient. Contrary to its technical counterparts, this rule is purely rhetorical in nature, as it is not based on any economic justification whatsoever. The price thus calculated is merely a self-referent utterance. And it seems to me that what we have here is some variation of what David Graeber has called the paradox of performativity. We can understand that the real function of the rhetorical rules is to convince the hoteliers of the legitimacy of the start-up's expertise. We understand as well that it is a function that cannot be fulfilled if the hoteliers are aware of this.

Several contemporary sociologists have made the observation that prices are set on the basis of others: behind every price there is a network of prices.¹¹⁹ In the present case, it is the control rules incorporated in the algorithm that weave the links of the network around the suggested price. The latter is calculated not only in relation to the prices reviewed (such as the minimum price, the rack, or that of the night before) but also by reference to the price actually applied by the user as well as its competitors' prices. I will therefore add to those already mentioned two control rules: one makes the recommendation be more or less in the price range of comparable hotels in the same area; the other ensures that the recommended price

¹¹⁹ Sandrine Barrey, « Formation et calcul des prix », *art. cit.*; Koray Çalışkan, 'Price as a Market Device: Cotton Trading in Izmir Mercantile Exchange,' in Michel Callon, Yuval Millo, and Fabian Muniesa (eds.), *Market devices*, Oxford: Blackwell, 2007, p. 241-60; Koray Çalışkan, 'The Meaning of Price in World Markets,' *Journal of Cultural Economy*, 2 (3), 2009, p. 239-268.

does not deviate ‘too far’ from the actual price applied by the hotelier. I have decided to deal with these rhetorical rules separately because, contrary to the self-referential case previously examined, it is indeed possible to build them upon an economic reasoning—although, of course, a reasoning that is quite different from the normal economics of revenue management. Anchoring the price suggestion to the median price of competing properties—properties that are selected by the hotelier herself—‘makes sense’ to the extent that, this way, ‘the hotel is correlated with its market to some degree,’ an engineer of PriceMatch explains. Likewise does a suggestion based on the actual price set by the hotelier because, and given that the algorithm cannot take into account all market variables as admitted by the developers themselves, no one knows better than the ‘man on the spot’ (as Friedrich Hayek would say) the ‘particular circumstances of time and place.’¹²⁰

This combination of optimisation algorithms and seemingly unsophisticated user-defined rules and strategies is noting less than puzzling. We have seen how theoretical approaches on pricing, and especially on seat inventory control, pertain to a peculiar representation of the market, substantiated by concepts from the operational research, and of which the justification conjures the frameworks of neoclassical economics. We now also see that the way the problem is solved at PriceMatch returns to a familiar theme of liberalism, especially in Ludwig von Mises’s and Friedrich Hayek’s thought.¹²¹ The idea that the optimum price cannot be the result of central planning—that is, an economic calculus that would attempt to integrate all the knowledge that ought to be used—is dear to the followers of this school of thought. Any calculation that is done centrally crashes into market incompleteness, due to inherent deficiencies with acquired knowledge and limitations in human cognitive capacity, and therefore creates biased depictions of the market. The only solution therefore is, according to these authors, to allow

¹²⁰ Friedrich Hayek, ‘The Use of Knowledge in Society,’ *The American Economic Review*, 35 (4), 1945, p. 519-30, p. 524 (quote).

¹²¹ Ludwig von Mises, *Economic Calculation in the Socialist Commonwealth*, S. Adler (trans.), Auburn, AL: Ludwig von Mises Institute, 1990 [1920]; Friedrich Hayek, ‘The Use of Knowledge in Society,’ *art. cit.*

‘some form of decentralisation’ ... ‘because only thus can we ensure that the knowledge of particular circumstances of time and place will be promptly used.’¹²²

What is more, it is possible that this is precisely the recognition of the limitations of the algorithm by the same people who developed it that explain the success of a company like PriceMatch or, in the words of James C. Scott, why the ‘start-up did not fail.’¹²³ PriceMatch revenue management system is quite remarkable in that it blends into one algorithmic solution the two types of knowledge Scott has discussed in *Seeing Like a State*—that is, the top-know knowledge of state planners and the ‘metis’, or tacit knowledge, of local actors. The result is contradictory in essence, but it produces a ‘real’ price (at least from the users’ point of view). We can even say that PriceMatch solution relies on its users in two ways, as the price thus calculated is only a suggested price that the hotelier is free to choose or not.

What is important here, however, is not so much the theoretical success of a certain economic representation but the fact that this cannot be said. And it is obvious why. With the last two rules I have mentioned, PriceMatch solution confines itself to following the hotelier in her analysis: the price suggested by the platform repeats, to some degree, the price chosen by the user (or that of competitors) and can therefore be analysed as tautology. Revealing and publicising this would be fatal to PriceMatch, as it would be to deny their own expertise on pricing and to say that in fine the hoteliers are well capable of setting their prices all by themselves, and especially without the help of an algorithm. Here, once again,

¹²² Friedrich Hayek, *ibid.*, p. 524.

¹²³ James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, New Haven, CT and London: Yale University Press, 1998. It is noteworthy that, surprising as this may seem, Scott’s theory of knowledge is not that different from Hayek’s (although, of course, the political implications that these authors draw from it are at the opposite ends). I am grateful to Mitya Zhikharevich who pointed this out to me. See also, on this, the review by American economist J. Bradford DeLong, ‘James Scott and Friedrich Hayek,’ *Grasping Reality with Both Hands: bradford-delong.com*, 24 October 2007 [online]. <http://delong.typepad.com/sdj/2007/10/james-scott-and.html> [Last consulted on 3 March 2018]

the paradox of performativity, or a variant of it, intervenes. ‘I think that he’s the biggest crook ever,’ explains an engineer of PriceMatch about his boss. ‘Because he knows perfectly well how it works but he manages to sell a thing that is different from what he knows it is. And he’s gifted for that because I myself wouldn’t be able to lie on the reality of the algorithm. He’s a crook but that’s a quality here.’ [Interview, 20 August 2014] When the start-up members *explain* to customers and other external stakeholders what is in the algorithm, they are very careful not to detail the rhetorical rules that we have been discussing (at the risk of losing all credibility in the eyes of their customers and of seeing the latter go elsewhere). To paraphrase Graeber: they have to insist that there is something else, something proper scientific behind their price suggestions, *what matters is that it is not seen as sheer performativity*. As a result, the technology of revenue management is often surrounded by a certain air of buncombe, hypocrisy, and lies.¹²⁴

Finally it is never entirely clear to what degree any given price is the result of supply and demand or institutions (broadly defined): almost always there is an element of both.¹²⁵ Certainly, this is the case at PriceMatch, where price suggestions are based so much on the knowledge and capabilities of the users, on the norms and regulations in the hotel industry, and the sense of fairness (what hoteliers mean when they say ‘customers would object’), despite of claims that revenue management purely is the practical application of price discrimination. What I have examined here is not how economic representations play some role in shaping markets and the economy in practice but rather the way certain arguments that we find in a purely logical form in political economy can be expressed in the structure of a concrete pricing algorithm but that the parameters of the algorithm cannot be revealed if we want to apply the logic in question. To this, I have shown the

¹²⁴ David Graeber, ‘The Sword, the Sponge, and the Paradox of Performativity,’ *art. cit.*, p. 29.

¹²⁵ Jane I. Guyer, *Marginal Gains: Monetary Transactions in Atlantic Africa*, Chicago, IL, and London: Chicago University Press, 2004; Jane I. Guyer, ‘Composites, fictions, and risk: Toward an Ethnography of Price,’ in Chris Hann and Keith Hart (eds.), *Market and Society: The Great Transformation Today*, Cambridge: Cambridge University Press, 2009, p. 203-20.

importance of seemingly trivial little schemes and rhetoric used by certain pricing specialists who pretend to be able to predict the occupancy rate on a given date and the price to charge to maximise the revenue of a property, in a situation that is insofar as it is political can be analysed as performativity.

5. Conclusion: Pricing as Technology of the Future

This essay has studied some of the social and political properties that come into play in price formation by means of a revenue management system: I have dwelled on a particular function of these systems that should make it possible in principle to determine discount allocation and produce a vector of prices, which in economic theory corresponds to the optimal solution under conditions of perfect price discrimination. A first section has focused on the airline case and on the revenue management system developed at American Airlines in the years following the 1978 Airline Deregulation Act. A second section has analysed the theoretical representations, which, in economics in general and in operational research in particular, justified the use of revenue management techniques, and interpreted its principles in terms of fairness. A third and last section has explored in practice how the rationalisation of a revenue management system for hotels could not rely explicitly on a theory of performativity.

The purpose of this essay was not to give an exhaustive account of all the many technical elements of revenue management systems, nor was it to analyse the social consequences of computerisation on professional practices. Instead I have sought to draw some relationships between rationalisations and tools by looking at a specific detail of the problem. I have described the way in which the algorithm integrate many economic justifications, and remarkably varied for that matter, according to a particular dialectics. Solving the problem of revenue management involve, in the case studied, the use of a theoretical artifice in the setting of price suggestions, which prevents the price from getting too far to the users' expectations. But this stratagem has to meet, in a way, the users' intelligence and judgment. It has to be built on something else, more real, and it cannot be produced in a strictly performative manner.

We thus could, by plunging into the intricacies of the algorithm developed by PriceMatch, unveil the tricks and ruses to which the start-up members give way to legitimise their expertise on the issue of hotel pricing. We have seen that revenue management, in its computing form, transfers agency from actors naturally limited in their cognitive capacities to a technology whose calculation power should make

it possible to obtain a price for a given room that maximises the revenue and profit of a particular property. This ideal of automation, that we can find in the scientific literature in particular in operational research, is also present at PriceMatch where the following contradiction appears clearly: on the one hand, the ‘industrialisation’ of revenue management is a proclaimed objective of the start-up; on the other hand, the solution in question reinvest by the back the user with her ability to act, through the rhetorical and algorithmic rules that I have described above. Thus this essay, ultimately, is a contribution to an anthropology of the limits of human knowledge in a field, that of operational research, where the technologies of the futures seem to combine some of the most sophisticated and the most scientifically-based mathematical formulae and computing techniques.

It belongs to the Actor-Network Theory (ANT) to have forcefully reminded us that markets and their main products—prices—but also economic theories are social constructs.¹²⁶ In the case presented here, we can even consider that it is not enough simply to create markets but to maintain them constantly by the actors’ intervention: critical situations, such as the construction of a market or the development of a pricing tool, where the economic theory plays a crucial role,¹²⁷ conceal the seemingly trivial work of maintenance and continuous production of beliefs, which takes place, in an unseen and convoluted way, by the very mediation of the technology. We cannot, however, limit ourselves to marvelling at the extent of the power of economics and, in particular, at approaches which the functionalist biases have long been expressly criticised. One of the advantages of describing price making as if it was a performance is precisely to insist on the political—and thus magical—dimension of economics: to try to understand, in other words, why the explanations and prescriptions of these experts always seem to be surrounded

¹²⁶ Certainly, ANT as developed by Bruno Latour and Michel Callon constitutes a notable continuation in the long debate about ‘embeddedness’ initiated by Karl Polanyi. Karl Polanyi, *The Great Transformation: The Political and Economic Origins of Our Time*, Boston, MA: Beacon Press, 2001 [1944].

¹²⁷ See, for example, Marie-France Garcia, « La construction sociale d'un marché parfait », *art. cit.*; Donald MacKenzie and Yuval Millo, ‘Constructing a Market, Performing Theory,’ *art. cit.*

by an aura of fraud. And, in the case of hotel pricing, it seems to me that the rhetorical rules that I have described above allow us to get a practical grasp of it. The market for revenue management technologies would thus be an ideal place to subject the social utopias of microeconomics, and the scope of their metaphors, to sociological analysis. The issue of the power of economists can thus be dealt with in several ways: by observing how the always more complex and comprehensive mathematical formulae of economist-engineers enable the advent of a sort of superior reality, or by examining, for example, how it is as much a 'social effect,' which means in some cases to realise that the creations of economists are in a way scams, whose consequences are still no less real and significant. I have sought to contribute here to this questioning through the social effects that come into play in a revenue management system: this kind of tool seems indeed particularly well suited to a social theory which aims at the study of technologies of the future and to an aspect of human condition such that our knowledge of events and history is fundamentally limited.

Appendix and References

Appendix A: Interviews

Name	Affiliation	Date	Duration
Peter P. BELOBABA	Massachusetts Institute of Technology	24 April 2012 and 17 July 2012	63 min. and 40 min.
E. Andrew BOYD	PROS	11 July 2012	45 min.
Duncan C. COPELAND	Harvard University	December 2013	-
Robert G. CROSS	Revenue Analytics	22 June 2012 and 3 July 2012	25 min. and 95 min.
Kenneth LITTLEWOOD	British Airways	8 February 2013	68 min.
Robert L. PHILIPS	Columbia University	26 June 2012	65 min.
Barry C. SMITH	American Airlines	January 2014	-
Garrett J. VAN RYZIN	Columbia University	14 September 2011	98 min.

Table A.1. List of interviews, academics and other practitioners.

Name	Occupation	Date	Duration
Basile	Human resources manager	29 September, 2014	116 min.
Adriane	Account manager	21 August, 2014	89 min.
Cédric	Developer	11 September, 2014	193 min.
Augustine	Marketing manager	30 July, 2014	115 min.
Baptiste	President	21 August, 2014	88 min.
Alexandre	Head of sales	1 September, 2014	105 min.
Arnaud	IT technician	23 April, 2015	84 min.
Bastien	Account manager	27 March, 2015	112 min.
Alexis	Account manager	27 March, 2015	85 min.
Alex	Account manager	21 August, 2014	121 min.
Christine	Head of Telemarketing	3 April, 2015	66 min.
Erwann	Account manager	30 March, 2015	82 min.
Hervé	Developer	26 March, 2015	59 min.
Antonin	Account manager	28 March, 2015	75 min.
Karim	Salesperson	7 April, 2015	73 min.
Philippe	Marketing manager	30 March, 2015	78 min.
Alban	Human resources manager	7 April, 2015	69 min.
Yoan	Head of Partnership	1 August, 2014	126 min.
Cyril	Developer	6 April, 2015	76 min.
Christian	Account manager	20 August, 2014	139 min.
André	IT technician	27 April, 2015	85 min.
Ilan	Developer	6 April, 2015	91 min.
Feriel	Co-director of Account Management	22 August, 2014	191 min.

Bryan	Developer	6 April, 2015	77 min.
Adil	Director of Sales	22 September, 2014	100 min.
Helios	Co-director of Account Management	8 April, 2015	76 min.
Aurélien	Developer	10 September, 2014	92 min.
Guillaume	Telemarketer	29 July, 2014	108 min.
Antoine	Developer	24 April, 2015	67 min.
Julien	Co-director of Development	18 September, 2014	92 min.
Léo	Vice-president	24 September, 2014	87 min.
Sébastien	Developer	21 August, 2014	137 min.
Maxime	Developer	20 August, 2014	99 min.
Karen	Office manager	30 March, 2015	62 min.
Carine	Account manager	4 August, 2014	120 min.
Elias	Co-director of Development	20 August, 2014	108 min.
Sofia	Account manager	2 April, 2015	66 min.
Romarc	Developer	10 September, 2014	127 min.
Hugo	Head of Algorithm	27 March, 2015	69 min.
Théo	Salesperson	8 April, 2015	70 min.
Lucas	Account manager	5 August, 2014	75 min.
Arjun	Director of Operations	1 April, 2015	105 min.

Table A.2. List of interviews, PriceMatch members.

Name	Occupation	Date	Duration
PM1	Receptionist	15, April, 2015	66 min.
PM2	Hotel manager	17 April, 2015	52 min.
PM3	Hotel manager	14 April, 2015	26 min.
PM4	Management assistant	14 April, 2015	99 min.
PM5	Hotel manager	8 December, 2015	74 min.
PM6	Hotel manager	13 April, 2015	33 min.
PM7	Investor	13 May, 2016	52 min.

Table A.3. List of interviews, other stakeholders at PriceMatch.

Appendix B: Survey

Data

A questionnaire survey was conducted in the start-up during the summer of 2014. It provided standardised responses which can be subject to quantitative analysis: 34 people replied to the questionnaire (of the 38 members of PriceMatch at the time), that is, a response rate of 89 percent. In the spring of 2015, I launched a second survey among the new team members, and thus doubled the number of responses received. However, I will not use these data in this thesis.

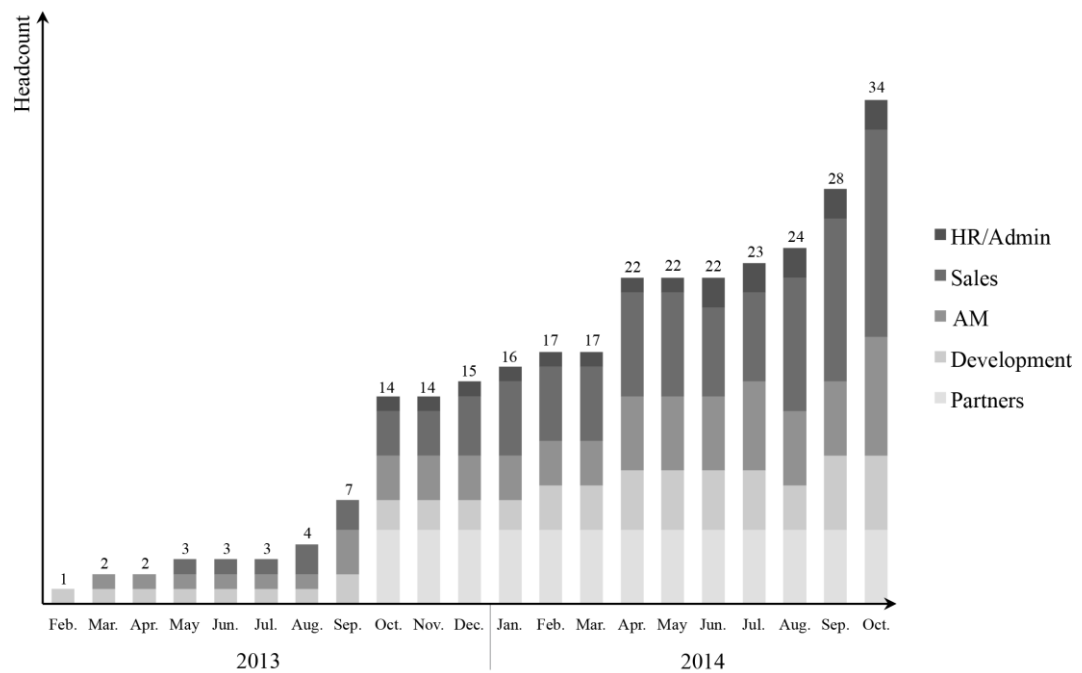
Table of 34 rows (individuals) and 50 columns (variables).

Variables: function 6 [variables]: occupation, tasks, previous occupation in the start-up, status, command responsibility, member of Comex; recruitment 3: modality recruitment, arrival date, probation; previous working experience 4: previous occupation, reasons for leaving previous occupation, experience in the hotel industry, experience in revenue management; working conditions 18: salary, bonus, view on bonus scheme, effort vis-à-vis wage, hours worked, evening work, weekend work, work pace, holidays taken, satisfaction at work, stress at work, atmosphere, relations with colleagues, causes of tensions, friendship, meetings outside of work, desire to leave the start-up, reasons for leaving it; views on revenue management 5: 'last minute' pricing, 'early bird' pricing, 'ascendant yield,' price volatility level, ethics of revenue management; knowledge in revenue management 4: 'Littlewood's rule,' EMSR, dynamic programming, readings; social properties 10: age, sex, date of degree completion, diploma, subject, university or *grande école*, father's diploma, father's occupation, mother's diploma, mother's occupation.

Selected Results

Occupations	Female	Male	Total
Developer - algorithm		4	4
Developer - back end		2	2
Developer - front end		2	2
IT		2	2
Account manager	4	3	7
Salesperson	2	6	8
Country manager		2	2
Cold caller	1	1	2
Director (HR/marketing/partnership/etc.)		4	4
Admin	1		1
Total	8	26	34

Table B.1. Occupations in the start-up by sex.



Source—Excerpt from the comprehensive staff register (in French, *Registre unique du personnel*), February 2013 to October 2014.

Graph B.1. Change in team size over time, employees only.

Two-year degree	15%
Three-year degree	15%
Four-year degree	0%
Five-year degree	3%
Minor business school	12%
Major business school	6%
Minor engineering school	6%
Major engineering school	9%
Sciences Po	15%
Ecole Polytechnique	21%

Table B.2. ‘How far did you go in school?’

	In the start-up	Engineers, executives and intermediate occupations in the private sector under 36 years
Learned professions (doctors, lawyers, etc.)	9%	3%
Private executives	28%	15%
Public executives	22%	9%
Engineers	6%	6%
Intermediate occupations (teacher, service, etc.)	3%	34%
Sole traders, craft and related trades workers	22%	7%
Clerical workers		37%
Blue-collar workers	16%	17%
Farmers, clerical and blue-collar workers		1%
	3%	0%

Source—INSEE, Enquête emploi en continu 2014.

Table B.3. Fathers' socio-occupational status.

Learned professions (doctors, lawyers, etc.)	12%
Private executives	18%
Public executives	9%
Engineers	0%
Intermediate occupations (teacher, service, etc.)	32%
Craft and related trades workers	9%
Farmers, clerical and blue-collar workers	6%
Non working	6%
N/A	9%

Table B.4. Mothers' socio-occupational status.

Salary	Director (partner/HR/ marketing/etc.)	Developer	Account manager	Salesperson	Trainee, or other provisional contractor	Total
< 18k€	100%	20%	33%	10%	75%	44%
18 to 24k€	0%	20%	33%	40%	25%	26%
> 24k€	0%	60%	33%	50%	0%	29%

Table B.5. Percent wage distribution by occupation.

Account manager	40.7
Developer	42.4
Director (partner/HR/partnership)	53.0
Salesperson	47.1
Trainee, or other provisional contractor	38.3
Total	44.1

Table B.6. Average weekly working hours by occupation.

Appendix C: Multiple Correspondence Analysis

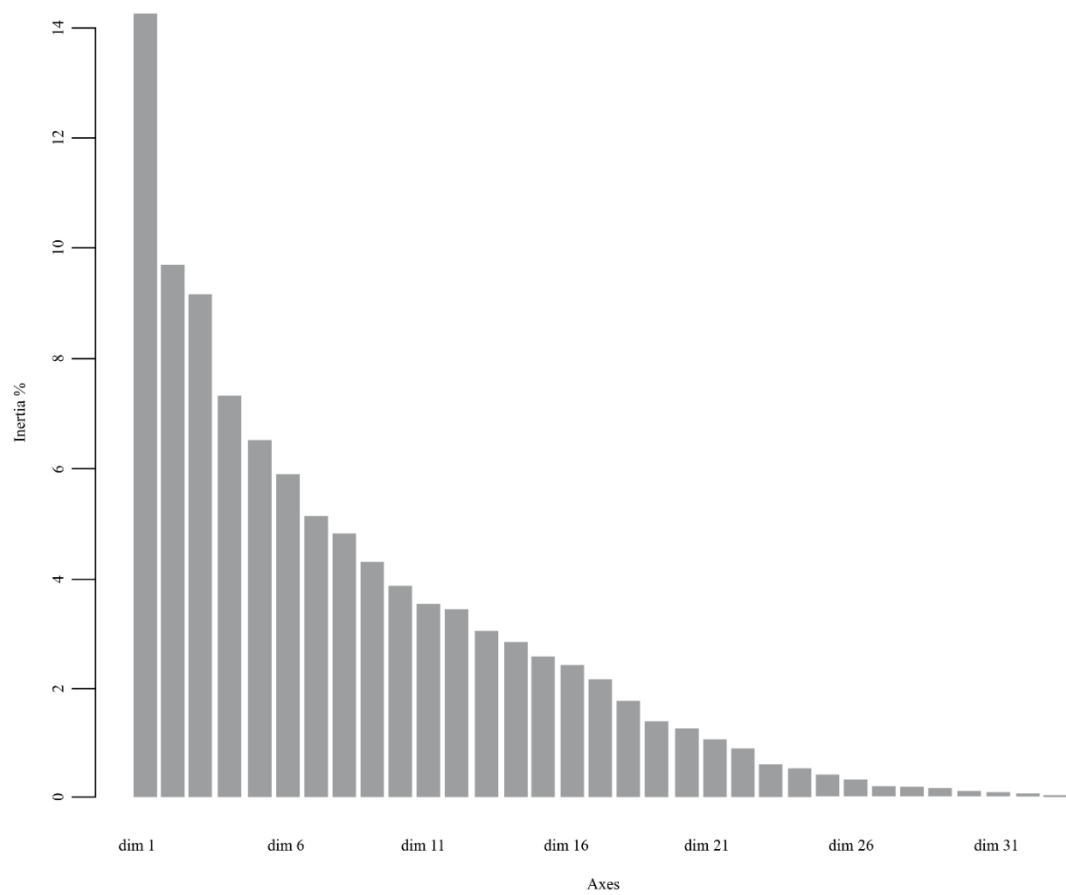
Data and Results

The multiple correspondence analysis (MCA) shows the distinguishing features of positions held in the company (active variables), and the social characteristics as supplementary. Active variables include: team, occupation, status, location, hierarchical position, participation on the executive committee, number of hours worked, salary received, bonus received, seniority, and experience in hospitality and in revenue management. Supplementary variables include: age, sex, degree, and father's occupation.

Table of 34 rows (individuals) and 16 columns (variables) including 4 illustrative variables.

Variables: team 6 [levels]; occupation 12; status/type of contract 7; location of office 4; hierarchical position 2; ExCo member 2; number of hours worked 4; remuneration 5; bonus 2; length of service in the company 5; experience in hospitality 2; experience in RM 2.

Illustrative levels: age 3; sex 2; degree 10; social class 7.



Graph C.1. Eigenvalues histogram.

	Eigenvalue	Percentage of Variance
Dim 1	0.4866	14.24
Dim 2	0.3318	9.71
Dim 3	0.3136	9.18

Table C.1. Eigenvalues.

Strongest Contributions

Dim 1		Dim 2		Dim 3	
Baptiste	12.1	Tristan	14.5	Hanna	17.9
Léo	12.1	Aymeric	10.6	Arnaud	12.9
Alex	7.1	Christine	9.2	Carine	7.3
Elias	6.7	Léa	7	Alex	6.8
Julien	6.7	Fatih	5.7	Aymeric	6.7
Aymeric	6.5	Théo	4.1	Tristan	6.5
Carine	5.7	Guillaume	4	Cédric	5.4
Tristan	5.6	Baptiste	3.5	Feriel	5.2
Christian	4.9	Léo	3.5	Lucas	3.9
Adil	4.8	Karim	3.2	Sébastien	3.6
Samantha	4.7	Robin	2.9		
Basile	3.8	Alex	2.8		

Table C.2. Levels contributions, individuals.

Dim 1		Dim 2		Dim 3	
> 45h.	8.9	SALES	12.5	< 35h.	10.2
ExCo	8.3	Count.Mgr.	6.3	Appshp.	8.1
Partner	7	VIE	6.3	AM	7.4
Resp.	6	LesHalles	6.3	Acc.Mgr.	7.4
Hosp.Exp.	5.4	Bonus	6.2	Admin.	4.8
> 1 yr.	4.9	< 2 mo.	5.8	RMExp.	4.4
RMExp.	4.2	Sentier	5.3	Hosp.Exp.	4.1
AM	4.1	Salesperson	5.1	< 12k€	3.7
Acc.Mgr.	4.1	24 to 30k€	5	IT	3.6
Dir.	4.1	San.Fran.	3.6	Count.Mgr.	3.5
no ExCo	3.5	DEV.	3.5	VIE	3.5
12 to 18k€	3.5	12 to 18k€	3.1	DEV.	3.5
no Resp.	2.9	Rome	2.7	< 2 mo.	3.1
< 12k€	2.6	C.Caller	2.7	Support	3
35 to 40h.	2.3	AM	2.6	ExCo	2.8
40 to 45h.	2.3	Acc.Mgr.	2.6	Indep.Contr.	2.4
CEO	2.1	Partner	2	Algo.	2.2
COO	2.1			Rome	1.8
Count.Mgr.	2.1			San.Fran.	1.8
VIE	2.1				
no Hosp.Exp.	1.9				

Table C.3. Levels contributions, variables.

Appendix D: User Interface

Prototype

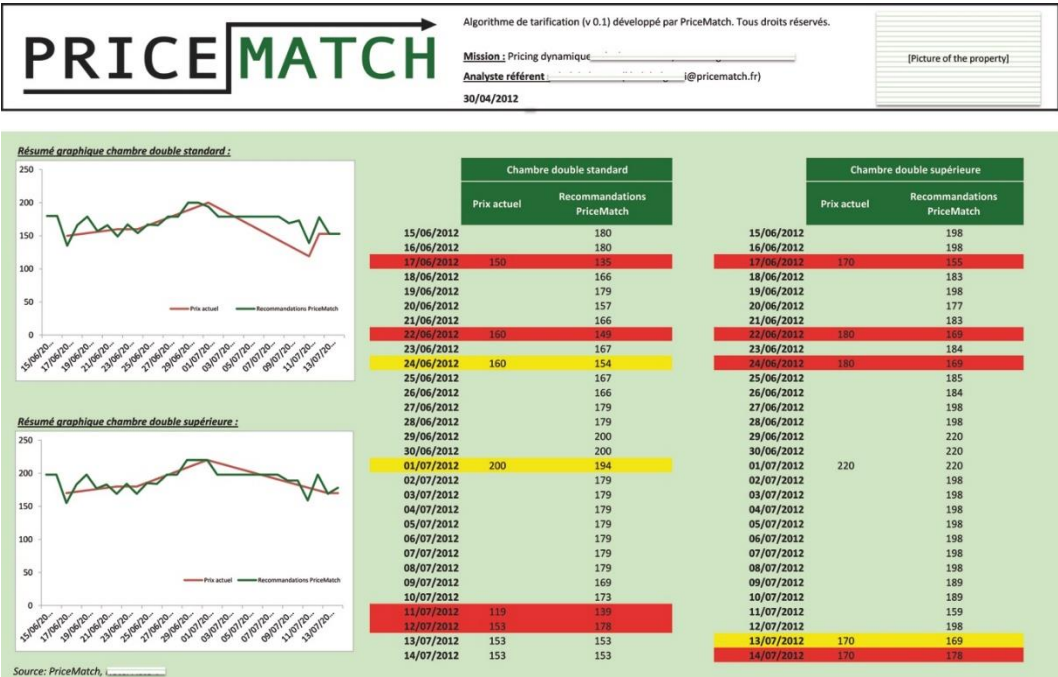


Figure D.1. Calendar view, June 2012.

Note—On the right-hand side, two distinct tables, one for each room type, show the list of the actual prices and that of the price recommendations made by the algorithm for the coming thirty days. On the left-hand side, corresponding graphs represent the variations of the actual price (in red) and of the recommendation (in green). Also highlighted in the tables are the dates for which the gap between the actual price and the recommendation is relatively significant: cells turned yellow if the difference is less than five per cent and red if it is more than that.

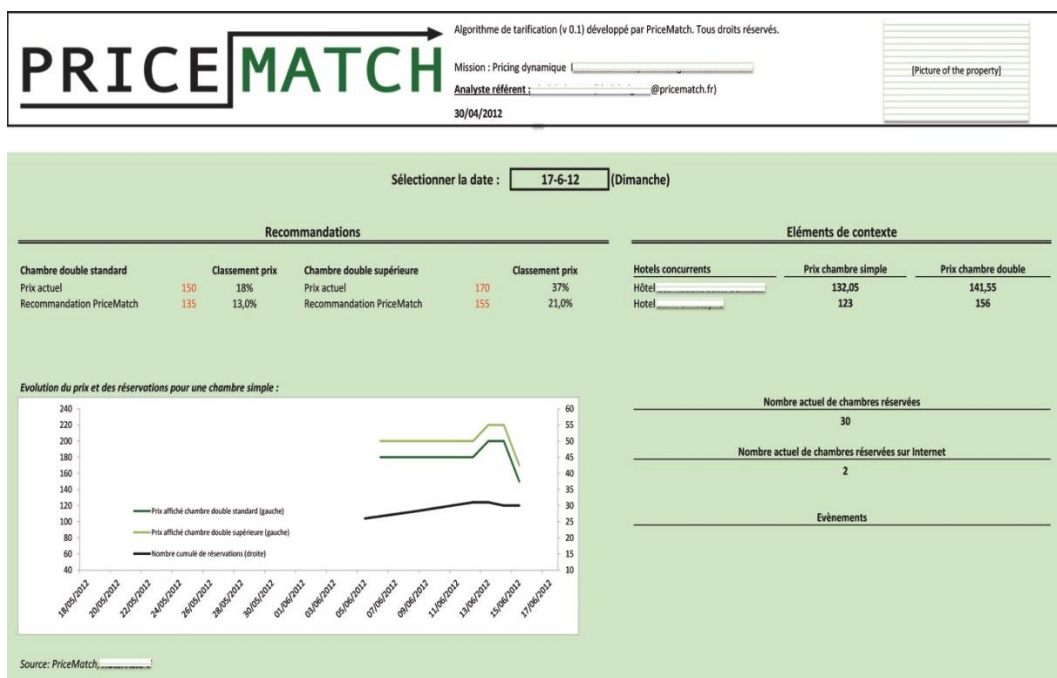


Figure D.2. Detailed view, June 2012.

Note—In addition to the information on price and recommendation given in the overview tab, other factors such as competitor prices and local events that may affect the demand are shown here. A graph also gives the evolution of the actual prices for each room type and reservations taken over the booking period for a given date.

Final Production

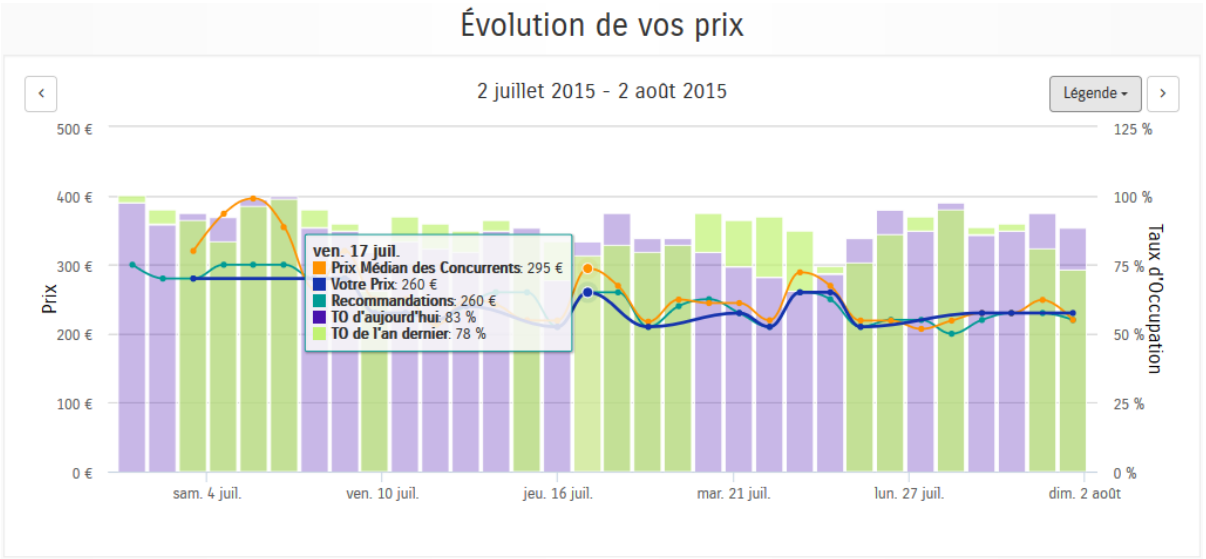
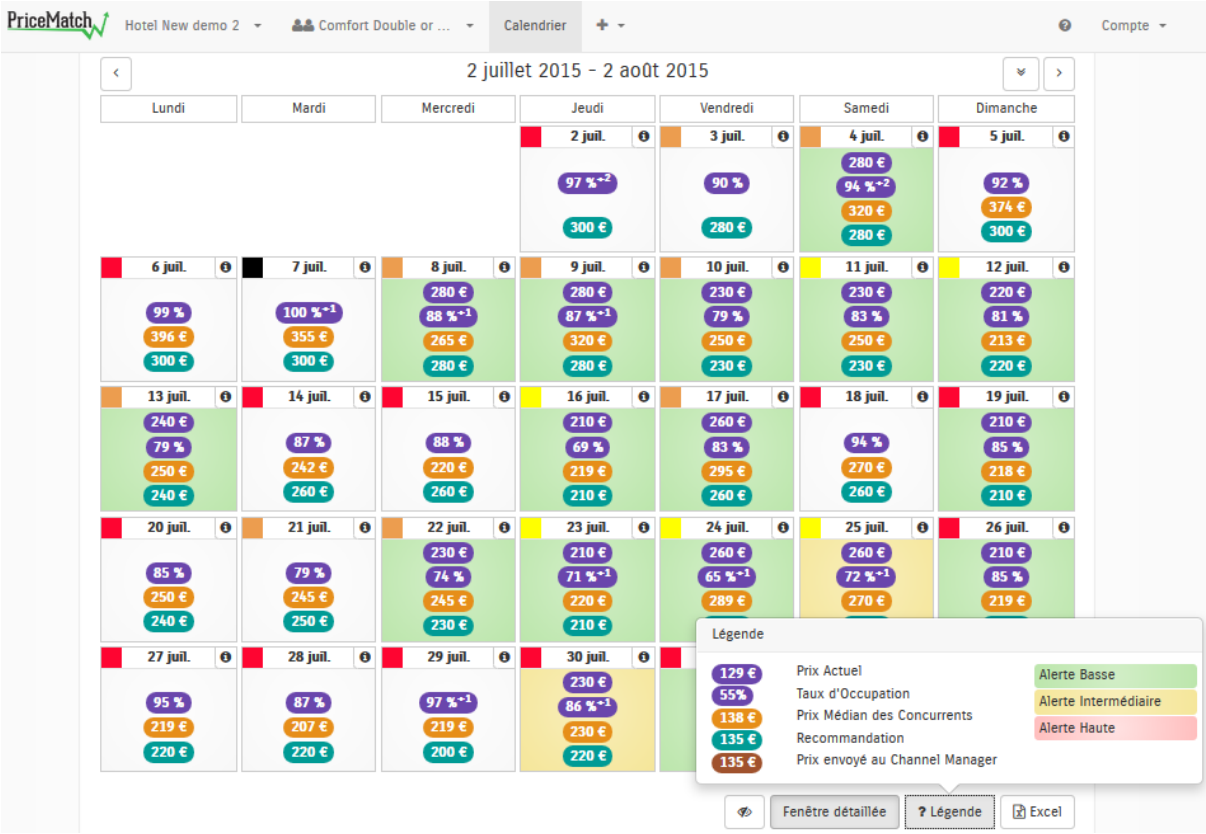


Figure D.3. Calendar view, July 2015.

Concurrents

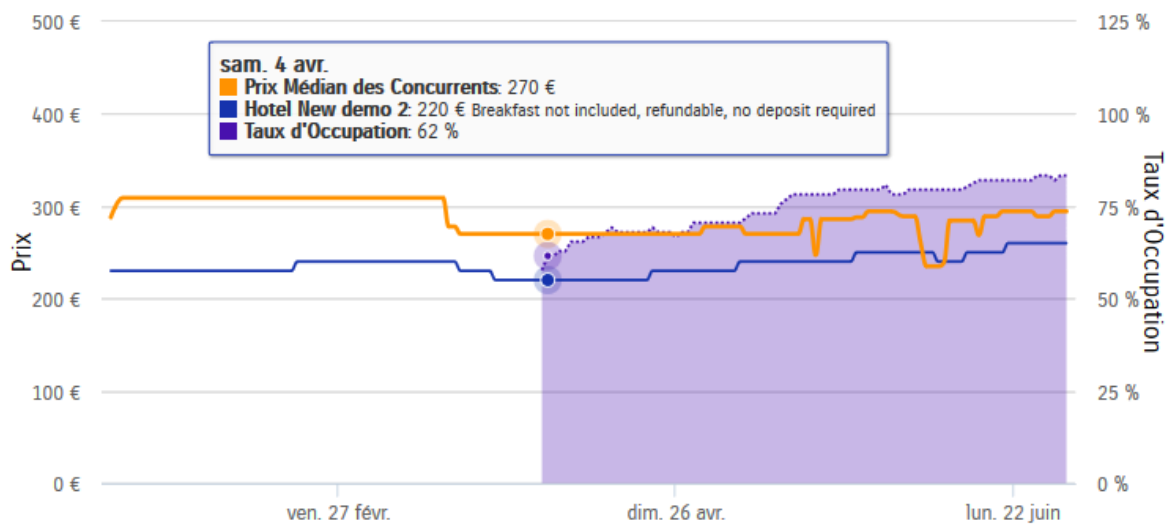
Taux d'Occupation

Recommandations

Évolution des Prix



Légende ▾

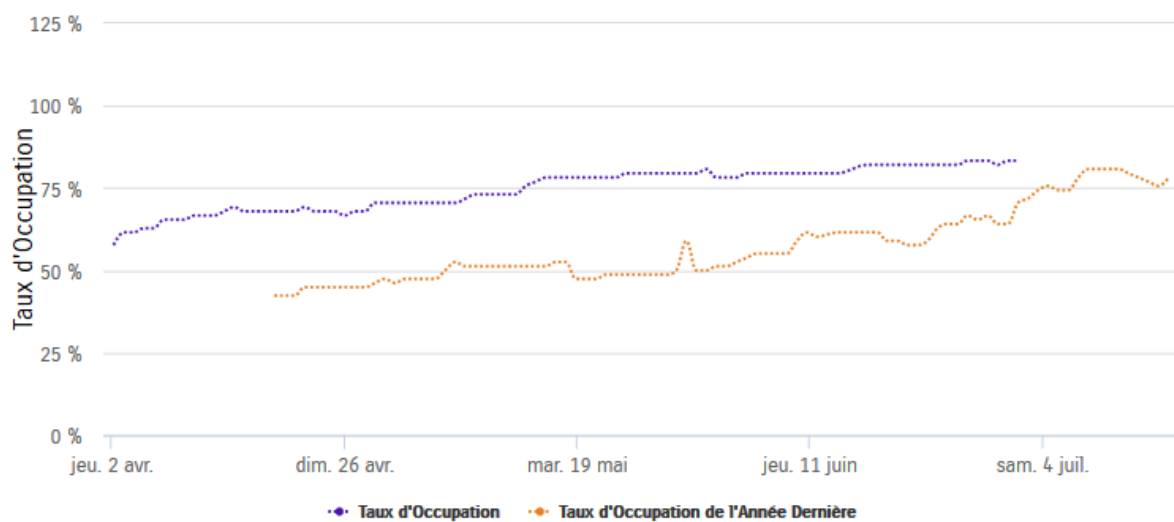


Concurrents

Taux d'Occupation

Recommandations

Montée en Charge



	Réservations	Taux d'Occupation
Nombre de Réservations	65	(83 %)
Réservations Prédites	73	(94 %)


Concurrents
Taux d'Occupation
Recommandations

Rate Levels

Ouvrez : A,B

Canaux de Vente

Direct (No - Distrib)

 Comfort Double or Twin Room

Prix Actuel260 €

Recommandation260 €

Masquer cette recommandation pendant x jours

Chiffre d'Affaires Quotidien

CA
Prix Moyen

Événements

Vacances d'été

Spain : Verano

Chiffres du vendredi 18 juillet 2014

Taux d'Occupation78 %

Prix Moyen189 €

Note

Figure D.4. Detailed view, July 2015.

Appendix E: Heuristics versus Optimal Models

Kenneth Littlewood introduced the idea that, in a deregulated environment, airlines should better maximise the revenue received on a particular flight rather than the number of passengers carried.¹ He proposed a model of controlling low-yield fares when two fare classes are involved. Based on surveys it is assumed that the low-yield passengers book first, followed by the high-yield passengers. To maximise revenue, low-yield passengers should continue to be accepted until:

$$f_2 \geq (1 - P)f_1$$

Where f_1 is average revenue obtained from a high-yield passenger and f_2 from a low-yield passenger, and P the maximum risk that the acceptance of a low-yield passenger will result in the subsequent rejection of a high-yield passenger. This has come to be known as ‘Littlewood’s rule.’

Peter Belobaba proposed a generalisation of this equation to more than two fare classes called the EMSR method.² Most importantly, he took into account the way in which inventory is structured in practice: reservations systems are ‘nested,’ that is, the fare class inventories are structured such that a high fare request will not be refused as long as any seats remain available in the lower fare classes. In a nested fare class reservation system, each booking limit is the maximum number of seats that may be sold to a fare class. Several other assumptions are made:

1. Demand for each fare class is separate and independent of demand in other classes;

¹ Kenneth Littlewood, ‘Forecasting and Control of Passenger Bookings,’ *Journal of Revenue and Pricing Management*, 4, 2005 [1972], p. 111-23.

² Peter P. Belobaba, *Air Travel Demand and Airline Inventory Seat Inventory Management*, Doctoral Thesis, Cambridge, Massachusetts Institute of Technology, Dept. of Aeronautics and Astronautics, 1987; Peter P. Belobaba, ‘Application of a Probabilistic Decision Model to Airline Seat Inventory Control,’ *Operations Research*, 37, 1989, p. 183-97.

2. Demand for each class is stochastic and can be represented by a probability distribution (usually normal);
3. The lowest fare class books first, followed by the next lowest class, etc.

Belobaba defines $EMSR_i$ to be the expected marginal seat revenue for class i when the number of seats available to that class is increased by one:

$$EMSR_i(S_i) = f_i \cdot P(S_i)$$

Where, f_i the average fare level for class i , $P(S_i)$ the probability that another request for class i will be received given S_i , the number of seats allocated to that fare class.

Shortly afterwards, the non-optimality of the EMSR approach was reported independently by several operational researchers. For example, Jeffrey I. McGill and Shelby L. Brumelle noted that the EMSR method determines the optimal protection level for the full-fare class but is not optimal for the remaining fare classes (either over- or underestimating the optimal protection levels).³ Alternatively they show that, under certain continuity conditions, an optimal set of protection levels p_1^*, p_2^*, \dots can be obtained via sub-differential optimisation calculation within a stochastic dynamic programming framework. The following conditions must be satisfied:

$$\delta_+ ER_k(p_k^*) \leq f_{k+1} \leq \delta_- ER_k(p_k^*)$$

And:

$$f_2 = f_1 P(X_1 > p_1^*)$$

$$f_3 = f_1 P(X_1 > p_1^* \cap X_1 + X_2 > p_2^*)$$

\vdots

$$f_{k+1} = f_1 P(X_1 > p_1^* \cap X_1 + X_2 > p_2^* \cap \dots \cap X_1 + X_2 \dots + X_k > p_k^*)$$

Where $ER_k(p_k)$ is the expected revenue from the highest fare classes when p_k seats are protected for those classes, and δ_+ and δ_- denote the right and left derivative with respect to, respectively.

³ Jeffrey I. McGill and Shelby L. Brumelle, 'Airline Seat Allocation with Multiple Nested Fare Classes,' *Operations Research*, 41(1), 1993, p. 127-37.

Largely in response to this criticism, Belobaba coined the EMSRb model that avoids the statistical averaging effect produced by aggregating demand across classes in the previous version of EMSR (relabelled EMSRa).⁴ However the proposed solution using the weighted-average has in turn been deemed to be ‘a somewhat crude approximation.’⁵

⁴ Peter P. Belobaba, ‘Optimal vs. Heuristic Methods for Nested Seat Allocation,’ Presentation at ORSA/TIMS Joint National Meeting, November 1992; Peter P. Belobaba and Larry R. Weatherford, ‘Comparing Decision Rules that Incorporate Customer Diversion in Perishable Asset Revenue Management Situations,’ *Decision Sciences*, 27, 1996, p. 343-63.

⁵ Kalyan T. Talluri, Garrett J. van Ryzin, *The Theory and Practice of Revenue Management*, Berlin, Springer Science + Business Media, 2004, p. 36-7.

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